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The Vale of Glamorgan

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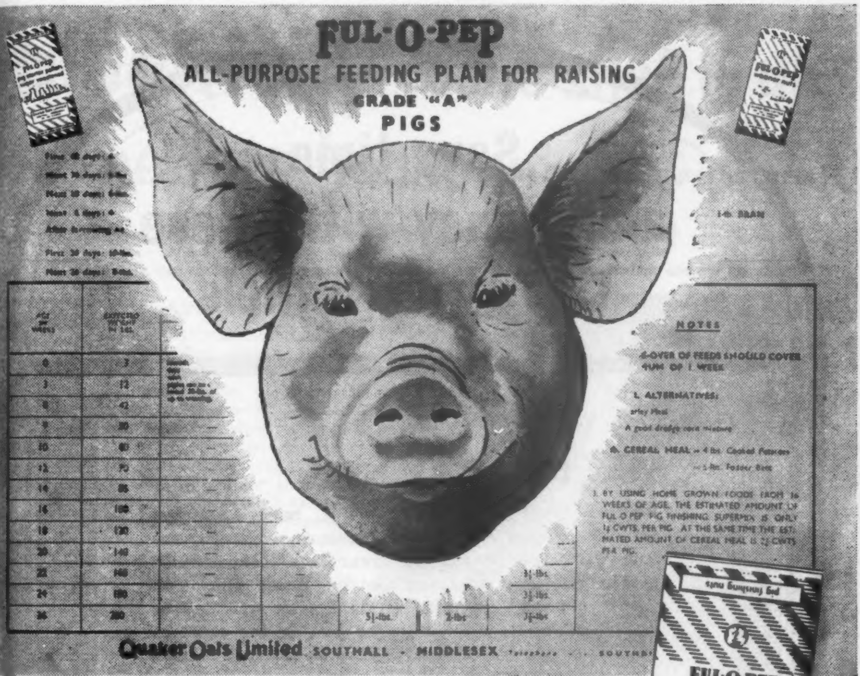

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AGRICULTURE

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MYXOMATOSIS: A SURVEY

HARRY V. THOMPSON

Infestation Control Division, Ministry of Agriculture, Fisheries and Food

Myxomatosis was first notified in Britain 2½ years ago, but since then it has spread to practically every parish. This, therefore, is perhaps an appropriate time to consider the tremendous changes wrought and the many problems posed by this disease, not only here, but in Australia and Europe too.

JUST over two years ago, when the first of this series of articles* appeared, myxomatosis had secured a foothold in the country and the possibility of its spreading widely during the spring and summer of 1954 was anticipated. Myxomatosis is no longer an obscure disease but a household word; it has ravaged the rabbit population of Britain, as it did those of Australia and France, and has profoundly affected our agriculture and wild life. In many parts of Britain the rabbit is no longer a common animal and, as a result, trees may be planted without the use of protective netting and good crops have been grown on fields previously grazed bare by rabbits.

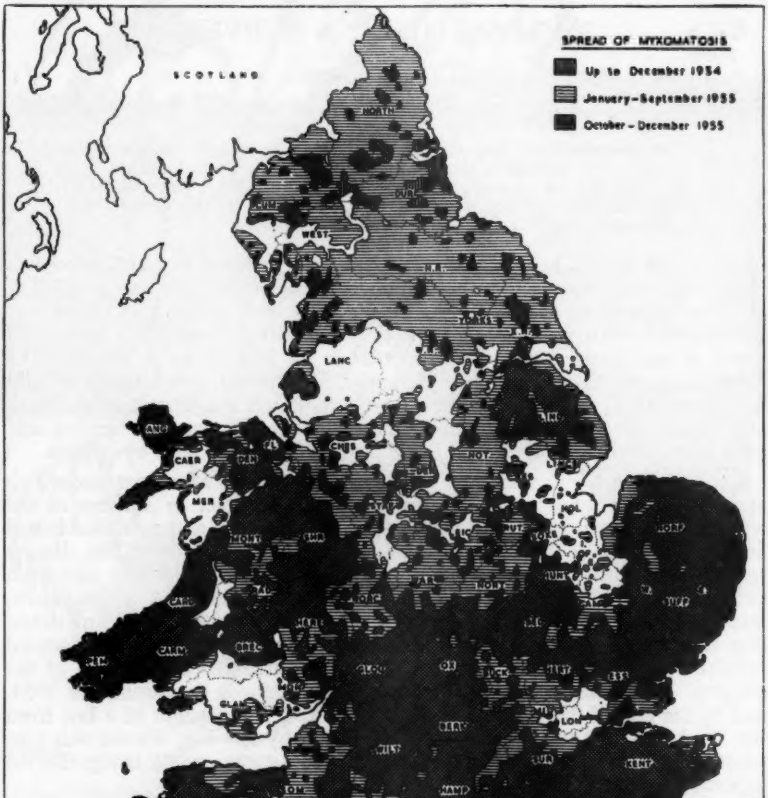
Let us return for a moment to the spring of 1954. Myxomatosis, which arrived in Kent by means unknown in the late summer or autumn of the previous year, had resisted all attempts to stamp it out and was established at twelve places in the south-eastern counties of England. The disease spread fairly slowly at first, but was reported from Wales in May and from Scotland in July. The rabbit flea, and not mosquitoes as in Australia, was found to be the main natural carrier of the virus, but there was no doubt that the spread of the disease was assisted and accelerated by diseased rabbits being taken from known myxomatosis areas to other parts of the country. The disease continued to spread throughout the autumn of 1954, and by the end of the year most of England and Wales south of a line from the Wash to the Wirral peninsula was affected by it. The disease was also seeded in many places in the north of England—every county being affected to some extent.

The deliberate spreading of the disease by some individuals gave rise to much public concern, and led to an amendment to the Pests Bill (which became the Pests Act on November 25, 1954) making it an offence to use a rabbit infected with myxomatosis to spread the disease among uninfected rabbits. This Act also authorized the Minister to designate rabbit-clearance areas and gave him greater powers to enforce rabbit destruction.

Early in January 1955, the Advisory Committee on Myxomatosis (appointed by the Minister of Agriculture and the Secretary of State for Scotland on November 3, 1953) presented its second report. After considering the spread of myxomatosis, the effect of the disease on the rabbit, the

* Myxomatosis of Rabbits. *Agriculture*, 1954, **60**, 503-8.

vaccination of domestic rabbits and other matters, the Committee recommended that every advantage should be taken of outbreaks of myxomatosis to eliminate rabbit survivors and prevent them from again building up their numbers. Throughout 1955, myxomatosis continued to spread, maintaining its high virulence—except in two places mentioned later—and causing a mortality of about 99 per cent. By the end of the year, the disease was present in most parishes in England, Wales and Scotland, although in a few counties where rabbits had never been numerous there were quite large areas to which it had not penetrated.



The brilliant summer of 1955 was accompanied by bumper harvests of many crops, a sizable proportion of which could be attributed to the absence of rabbits. Some farmers cut twice their normal crop of hay, and cereal crops grew right up to the hedges, where usually the headland had been

eaten by rabbits; other farmers were able to enlarge their beef and dairy herds. On October 13, 1955, the second anniversary of the notification of myxomatosis in England, the Minister of Agriculture held a Press Conference and emphasized that although the good crops of cereals could be partly accounted for by the excellent weather, they owed a great deal to the land's freedom from rabbits. It is difficult to translate this increased yield into figures, but the net gain to cereals alone, after taking into account the exceptional weather, is estimated at not far short of £15 million. In addition, there were considerable gains from pastures and leys which, in the long run, may well prove to exceed that from cereals, and substantial benefits to market-garden crops and to forestry.

Means of Spread The principal natural carrier of myxomatosis in 1955, as during the previous year, was the common rabbit flea (*Spilopsyllus cuniculi*), and striking confirmation of its importance was provided on the island of Skokholm, off the Pembrokeshire coast. Rabbits are still numerous on this island, and they appear to be completely free from fleas; myxomatosis has not become established there, although it has destroyed most of the rabbits on the neighbouring island of Skomer, where rabbit fleas are present.

Research on woodland mosquitoes during 1955 showed that in a hot summer—as in the cool summer of the year before—these mosquitoes were not attracted to healthy rabbits, and they can have played little, if any, part in the spread of myxomatosis. In this country relatively few domestic rabbits have been affected by the virus, but in several instances outbreaks have been associated with the presence of the coastal mosquito, *Anopheles maculipennis atroparvus*. This mosquito has been found carrying infection in the same hutches as myxomatous rabbits; it can live over the winter, feeding at intervals, and the virus can survive in it for over six months. But since the virus has not been recovered from mosquitoes caught outside the hutches, these insects are unlikely to be important carriers.

Studies have been continued in the Edenbridge area of Kent, where myxomatosis was first notified in October 1953, and are of particular interest, because the spread of the disease here was almost entirely by natural means. Twelve months passed before this outbreak reached suburban London to the north and joined up with independent outbreaks to the south, east and west. Altogether it covered 375 square miles. The average speed of spread was three and a half miles a month—less than a thirtieth of that in Australia—and is consistent with the belief that the flea is the main natural carrier. On most farms the disease took about six weeks to pass through the rabbit warrens and, although the spread was erratic, very few rabbits escaped infection. Even so, this small residue bred successfully during 1955, thus emphasizing the need for vigorous control measures even after myxomatosis. In the Edenbridge area, as in other parts of the country, the disease has lingered on almost unnoticed, and sporadic cases of infection still occur among the greatly depleted rabbit population.

Attenuated Strains of Virus The appearance of attenuated, or weaker, strains of myxoma virus, under conditions of natural infection in the wild, was forecast long ago. No disease has ever been known to maintain a mortality rate closely approaching 100 per cent, and in the second outbreak year in Australia (1951-52) the rate fell to about 90 per cent, while in 1953 less virulent strains of the virus were isolated.

Many attempts have been made in Australia to replace the attenuated virus by a fully virulent strain, but without success. Rabbits infected with

the standard strain are ill and infective for about a week, but with attenuated strains they are ill for about three weeks. Mosquitoes thus have more opportunities of biting rabbits affected by the weaker strains and of transmitting these to healthy rabbits. The virus introduced into Australia in 1950 was recovered from wild rabbits in Brazil in 1911 and maintained in laboratory rabbits from then onwards, but the virulent "French" strain of myxoma was recovered from Brazilian rabbits relatively recently and produces larger tumours and more oedema than the Australian standard strain. Attempts were made, therefore, to introduce a "French" strain into Australia, and it was in fact established in two wild rabbit populations in 1954-55, before the natural epizootic began. However, during the natural seasonal epizootic the "French" strain was completely replaced by the slightly attenuated local strain.

Some attenuation of the myxoma virus in Europe had been expected but was not found until almost three years after the introduction of myxomatosis into France. In April 1955, strains of attenuated virus were isolated from wild rabbits in part of Sherwood Forest, Nottinghamshire, and from a domestic rabbit in the department of Loiret in France. These strains are at least as attenuated as the Australian field strains of reduced virulence, which cause a mortality of about 90 per cent.

Since October 13, 1953, when myxomatosis was first notified in Britain, rabbits that have survived outbreaks of the disease have been examined at the Ministry's laboratories at Weybridge. The majority of these rabbits were found to be susceptible to myxomatosis, and must have escaped infection in the wild, but some of them had immune bodies in their serum and had clearly survived an attack of the disease. Myxomatosis reached Sherwood Forest in September 1954, and, at first, this resulted in the normal high rabbit mortality. Early in 1955, however, rabbits were found to be surviving in considerable numbers in that part of the forest known as the Dukeries. Sick rabbits were found to be affected by a "nodular" type of infection, the small nodules sometimes covering an extensive area and appearing anywhere on the body, although mostly on the face and ears. During the early stages, the nodules contain fully virulent virus, but they later shrink and form scabs and the virus becomes reduced in virulence. Another strain of attenuated virus, also producing nodular symptoms, was isolated from a small population of rabbits near Winchester in Hampshire. Carefully organized rabbit clearance schemes are now in operation both in Sherwood Forest and in Hampshire.

Effects on Wild Life There has been much speculation about the repercussions on the "balance of nature" that might follow from a great reduction in the rabbit population. The best that we can say is that this "balance" is always in a state of fluctuation, that "nature" is remarkably resilient, and that some new state of equilibrium will be reached fairly rapidly.

Most concern has been felt about those predatory animals that were partly dependent upon rabbits for their food. It was feared that foxes, in particular, would take a much greater toll of poultry, lambs, sheep and game. But, although there have been complaints of excessive damage in some areas, the preying of foxes on stock over the whole country has not greatly increased. This may be attributed in no small measure to the vigilance and activity of fox destruction societies and the hunts. A fox survey, and studies of fox diet—based on stomach examinations—is at present in progress and will form the subject of a later article; but results so far indicate that foxes are eating whatever is available to them. Among lowland foxes, considerable

quantities of field voles, brown rats and vegetable matter have been found in the stomachs.

Work at Oxford University suggests that predation by foxes can result in a local decimation of field voles and wood mice. These rodents are also the prey of tawny owls, which may rear fewer young on account of the food shortage. Buzzards are also being directly affected by the shortage of rabbits, and studies by the Nature Conservancy and the British Trust for Ornithology showed that, in 1955, very few buzzards bred successfully in areas denuded by myxomatosis, although breeding was normal in places where rabbits were still available. A shortage of food appears also to be accelerating the eastward extension of the buzzard's range, but fears that it would increasingly attack poultry and game have been much exaggerated. From many parts of the country there have been reports of fewer stoats than usual being seen, but no surveys of this predator have yet been made.

Changes in natural vegetation due to the absence of rabbits are also being studied by the Nature Conservancy, and detailed records are being taken at ten places, mostly in the south of England. The species of plants at about 12,000 points, covering a distance of four miles in all, are sampled once or twice a year; the height of the vegetation is also measured and photographs taken in some places. Changes noted during the past year include a greatly increased growth of grasses and a spectacular show of spring flowers.

Developments in Australia Reference has already been made to the presence of weaker strains of virus in Australia. There, slightly attenuated strains, causing a mortality of about 90 per cent, are now most commonly found, and it is only rarely that a fully virulent strain causing over 99 per cent mortality is recovered. Nevertheless, it is reported from Australia that the summer of 1954-55 was very favourable for insect transmission of myxomatosis and that (although mortality was low in some areas), taking the country as a whole, rabbits are now at their lowest level for over half a century. Myxomatosis is now enzootic (permanently established) almost everywhere in Australia where rabbits are to be found and, although there is much local variation in disease activity, generally speaking an epizootic flares up each year—usually in the late spring or summer—and destroys the bulk of the rabbits.

Mosquitoes continue to be the most important carriers, and two species, *Anopheles annulipes* and *Culex annulirostris*, are pre-eminent. *Anopheles annulipes* feeds on rabbits above ground at night and also attacks them in their burrows during the day, whereas *Culex annulirostris* is a purely night-biting species. Further experiments have confirmed that transmission is mechanical, and it is now known that mosquitoes can maintain the disease at a low level of infectivity, as well as spread epizootic disease. There seems little doubt that the amount of disease activity is mainly dependent upon the production of large numbers of mosquitoes which, in turn, is a response to an increase in the area of surface water, following heavy rains.

Besides mosquitoes, only the black flies (*Simuliidae*) have proved to be important carriers, capable not only of causing local outbreaks of disease but of spreading it for distances of over fifty miles.

It is difficult to forecast the future, since the last six years have been wetter than usual and low rainfall would not favour the spread of myxomatosis. There is also laboratory evidence that the innate resistance of rabbits to myxomatosis is increased by breeding from carefully selected immune parents. Such selection could occur naturally among rabbits descended from survivors of successive outbreaks of myxomatosis, and the present dominance of attenuated strains of virus would accelerate the process. Since

inoculation campaigns, which attempted to replace the weaker virus by fully virulent strains, have had little success, the Australians continue to lay stress on follow-up measures of rabbit destruction by traditional methods.

Myxomatosis in France It will be remembered that myxomatosis first became established in Europe when, in June 1952, Professor Armand Delille caught two rabbits from his estate at Maillebois, in the department of Eure et Loir, inoculated them with virus and released them in his walled park. The disease spread rapidly and, by September 1953, was present in half the ninety departments of France. By the end of that year all but five departments were affected. The spread was notably capricious—as it was the following year in Britain—and in large areas unaffected by the disease, rabbits continued to damage crops.

Myxomatosis was widespread in 1954, and some nine-tenths of the wild rabbits in France were estimated to have died from it. Many domestic rabbits were affected in 1953-54, but few subsequently. By 1955, it was accepted that myxomatosis had become an enzootic, or permanently established, disease which ebbed and flowed among rabbit populations in many parts of the country. At the beginning of the year the mortality rate was still very high but, as mentioned earlier, an attenuated strain of myxomatosis was recovered from a domestic rabbit in April. Such strains may be present among wild rabbits, causing a lower mortality. There are certainly many rabbits in some parts of the country and it is estimated that they have recovered to about 15 per cent of their former numbers.

In France it was at first believed, on circumstantial evidence, that the disease was largely spread by contaminated grass and fodder, and that it was carried on the tyres of vehicles which had passed over myxomatous rabbits. But the association of the disease with rivers, its absence from much high ground, and its active spread during the summer months, all indicate that insect carriers have been playing a part. The likelihood that mosquitoes, and particularly *Anopheles maculipennis atroparvus*, are important carriers is now accepted.

Opinion in France has been strongly divided between the anti-rabbit farmers and foresters on one side and the pro-rabbit *chasseurs* on the other; the first group championed Professor Delille and some of the second group prosecuted him. Early this year there were two interesting developments in this connection. The Court of Appeal gave judgment against Professor Delille and in favour of a plaintiff who claimed that, following the introduction of myxomatosis, he had lost the possibility of shooting rabbits on his land; but the Court went on to say that the damage was slight, being offset by the increased yield of the plaintiff's crops, and awarded the small sum of 5,000 francs damages, instead of the one million francs claimed. Shortly after this decision, the National Federation of Foresters decided to show their gratitude to Professor Delille by subscribing to a medal for him, to be presented during the summer at a druid-like ceremony in the heart of a forest.

There are nearly two million *chasseurs* in France and many of them wish to re-establish the rabbit as their principal quarry. They tried, in 1953, to immunize large numbers of wild rabbits by inoculation with Shope's fibroma (which causes only a local tumour, but gives protection against the myxoma virus for at least six months) and to use them as natural buffers against the spread of myxomatosis. These efforts were not successful, but there are now high hopes that attenuated strains of virus will spread naturally. Another way of controlling the disease would be to breed a naturally resistant rabbit, and attempts were made to cross the North American cottontail with the

European rabbit. Artificial insemination was used on does of both species in the experiments but, although fertilization took place, the embryos failed to develop.

To increase available game, the French Government have recently authorized an expenditure of over £200,000 on the importation of hares, partridges and pheasants from Hungary, Czechoslovakia and Yugoslavia.

Elsewhere in Europe By early 1954, myxomatosis had spread from France to Belgium, Germany, Luxembourg, the Netherlands and Spain; and in August of that year some domestic rabbits in Switzerland were infected. Since then, the disease has continued to spread in all these countries and has covered much of the rabbit-infested areas; it was also notified for the first time from Austria and Italy, in August 1955. It is interesting that in Austria, Italy, Spain and Switzerland the reported cases of myxomatosis have been mainly among domestic rabbits, of which many thousands have died or have been destroyed to prevent the spread of infection. Further research may confirm that flying carriers, especially mosquitoes, are chiefly responsible for the continued spread of the disease.

The Present Position There are now, apparently, no really heavy rabbit infestations on the mainland of England and Wales, although some moderate ones exist and occasional rabbits, or small pockets of rabbits, are found in many places. Myxomatosis has spread to nearly all the formerly rabbit-infested parts of the country, but rabbits surviving an attack by a weakened strain of myxomatosis are immune to the fully virulent virus and, unless standard measures of every kind are applied, control will not be maintained.

Apart from the astonishing reduction in its numbers, the most significant event in Britain last year, from the rabbit's point of view, was the occurrence of attenuated strains of virus in two places. For us, this merely underlines the fact, already fully recognized in Australia, that myxomatosis is not the complete answer to all rabbit problems, but that follow-up measures are more than ever necessary.

The designation of rabbit clearance areas, authorized by the Pests Act, 1954, has met with a most enthusiastic response from the agricultural and forestry communities. The greater part of the country is now covered by such clearance areas, which usually embrace entire counties. It is no exaggeration to say that almost everyone is on the look out for rabbits, and although the responsibility for their destruction falls upon the occupier, the Ministry and its County Agricultural Executive Committees are helping in every possible way, including the provision of grants in aid of scrub clearance, the bull-dozing of warrens, rabbit fencing and the destruction of rabbits on common land. The potentialities of the rabbit as a major pest are now fully appreciated and the once-flourishing rabbit-trapping industry has, with the rabbit, suffered an eclipse. The complete elimination of the rabbit would be an undoubted gain to our economy, and it is only by aiming at extermination that its numbers will be kept within bounds.

ACKNOWLEDGMENTS

In compiling this brief survey, I have quoted from the work of many colleagues in Australia, Britain, France and other countries. Although they are too numerous to name individually, I should like to acknowledge them collectively. For further information, the reader is referred to the *Journal of the Australian Institute of Agricultural Science*, 1955, **21**, pp. 130-44, 250-3, and to *Nature*, 1955, **176**, pp. 1,155-6.

EARLY FAT LAMB

R. PHILLIPS, D.Sc., A.R.I.C.
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With the right breeding and management policy, early fat lamb production on lowland farms can supply a sellers' market and help to level out seasonal gluts and shortages.

IT is not generally appreciated that the average estimated quantity of mutton and lamb consumed yearly per head in this country is only 30 lb, of which less than one-third is home-produced. The remainder is imported, mainly from New Zealand and Australia. This quantity is surprisingly small when we consider that Great Britain has a sheep population of over 20 million, and that approximately one-third of our sheep are slaughtered every year for meat. There is, therefore, ample room for expanding home production, and according to Cheveley and Owen (1) this is a feasible proposition under present-day conditions.

Unfortunately, our deliveries of home-produced mutton and lamb nowadays vary from a mere trickle in the spring to a veritable flood in the autumn, for the simple reason that the majority of British sheep are kept on the uplands, and the annual lamb crop from those areas is not ready for slaughter until the autumn. In most years October has been the month of glut, but well-fed lowland lambs are usually fit for slaughter at about 18 weeks old, and occasionally even sooner. It seems, therefore, it is to the lowland lambs, which are sold in increasing quantities from Easter onwards, that we must look for greater supplies during the early months of the "lamb" season.

If lambs are to be ready in May, they would have to be born in January, and therefore conceived in the previous August. This putting forward of the normal tupping season from October to August must obviously influence the natural development of oestrum in the ewes during the shortening days of early autumn. But the Dorset Horn breed is, we know, capable of producing two crops of lambs in the year (although it is perhaps safer to say that ewes of this breed will produce three crops of lambs in two years). It is also known that most of the lowland breeds or cross-breds can be managed in such a way as to produce early lambs, and hormonal injections may well have some influence on the breeding cycle of sheep in the future.

During the war there was, of course, every inducement to keep lambs to a greater age to produce heavy weights. Nowadays another influence—the housewife—is having its effects. She demands smaller joints which are not over-fat, with the result that in some markets second-grade lambs make a better price per pound than the first grade. She has also shown a preference for home-bred lambs and has demanded more level deliveries throughout the summer months, with a particular penchant for those ready early in the season. Farmers have, therefore, every encouragement to supply this early market.

Weight for Age **It is sheer folly to expect upland areas to participate in early fat lamb production; neither can the marginal and middle land districts, particularly in the west, overcome the natural handicap**

of the climate to ensure January lambing. Consequently, it is only under lowland conditions, where the temperature in the spring is relatively high and an average of about two hours' sunshine daily can be expected from January to April, and where the rainfall is low, that it is possible to rear young lambs successfully during the first months of the year. In Wales, these areas are limited to the low-lying coastal districts and a few inland valley areas, particularly in the drier easterly border counties. But in England there are vast stretches which are suitable, although the southern coastal counties are perhaps pre-eminent for the purpose. The long growing season of these areas is the key to the successful exploitation of this system. During the war years some producers in the south were able to market fat lambs regularly in May and June at over 40 lb carcass weight, and a lot more have joined them since.

Many of the larger breeds and commercial types of sheep are suitable for producing early fat lamb, because, to a great extent, the size of the parents determines the size of the lambs at birth. And, other things being equal, birth weight is a very significant factor in the subsequent growth rate of the progeny. For example, a difference of 4 lb in the birth weights of two lambs may be equivalent to a difference of over 20 lb in live weight at 18 weeks. The heavier Down breeds in the southerly areas, the Dorset Horn, the Kerry Hill, and the Clun and Ryeland in the Welsh border country, seem to satisfy the conditions. The various types of half-bred ewe—for example, Border Leicester × Cheviot, the up-and-coming Border Leicester × Welsh and those from the Pennine Range by Wensleydale or Teasdale rams—have also been shown to be excellent breeders and mothers when mated with suitable Down rams. In addition, weight may be gained by exploiting the hybrid vigour which comes through crossing different breeds.

Care of the Ewe It should not be assumed from all this that suitable climate and the right parents are the only ingredients necessary in the production of early summer fat lamb. Wallace, in his high-low level experiments at Cambridge, has shown that the nutrition of the breeding ewe for 4-6 weeks before and after lambing matters most in the weights of the weaned lambs. Feeding at a low level during that time leads to low birth weights and a poor flow of milk, and consequently to low rates of growth—the very opposite of what the specialist in early lamb production wants.

There is usually plenty of keep for the flock in the back end of the year, but from December to April it often becomes difficult. In particular, the period from January to March—the so-called "hungry gap"—creates the greatest feeding problems. In frosty weather, when there is snow on the ground, it is impossible to take advantage of the foraging abilities of the flock, and hand-feeding becomes essential. Fortunately, if grass is fully exploited by the use of suitable strains, fertilizing, reseeding and controlled grazing, the length of time for hand-feeding for maintenance and production can usually be kept relatively short. It is important to bear in mind, however, that the nursing ewe, like the dairy cow, demands adequate feeding to maintain its full flow of milk and so ensure rapid growth in the lambs.

Care is also needed during the ewe's dry period, from the time the lambs are sold in May and June until about a month before lambing begins again, because of the great danger of the ewes becoming too fat. This can be avoided by keeping the flock on poor unimproved pastures and rough grazing, or by confining them on a bare paddock. Of the two, the latter is the more risky.

Immediately the lambs are sold, it is necessary to dry off the nursing ewes

as quickly as possible without damaging the udders. Isolation in a bare paddock and easing the tightly packed udders once or twice is usually successful. When this is done, it is advisable to keep the ewes on poor grass until the time comes in July to flush them with better grazing to induce early oestrum and mating in August. Raddle-marking the rams and noting the service days of each ewe, comes in useful at lambing time.

Tupping and Lambing Tupping should proceed quickly during August so that the subsequent lamb crop will all be dropped within a short time. This will ease the work of shepherding later on. After tupping, the ewes should be returned to poorer grass to avoid the grave risks of their becoming too fat on the fresh August grass. But, at the same time, they should not be allowed to lose condition and become unthrifty. A regular change of pasture by migrating the flock from field to field or paddock to paddock at weekly intervals is a very wise precaution during the autumn. Careful attention must also be given to avoid the many ills to which the breeding flock is liable, such as foot rot, fluke, worms and parasites. At the approach of December it is necessary to start " steaming up " the ewes so as to develop full-sized udders by the time they are due to lamb. In good grassland areas, new leys and reserved foggage are extremely useful for this. Green forage crops and trough feeding may have to serve in other areas.

Very careful shepherding is needed when lambing time is near. In exposed, bleak areas, shelter should be provided against the prevailing winds and storms, either by using high hedge banks and shelter-belts in dry fields or by building artificial shelters with straw bales, etc. It is at this time that the skill of the experienced shepherd is most valuable. Constant attention night and day in the minutest detail pays handsomely in saving the lives of ewes and lambs and in protecting them against the fox, the carrion-crow, stray dogs, and other enemies.

Once the risks of parturition are surmounted, every encouragement should be given to the ewes to come into full milk production. During January and the frosty, snowing days of February, when the ground is bare, artificial feeding will invariably be necessary. Good quality hay, dried grass, mangolds and silage are the common home-grown foods for maintenance, with dry, concentrated balanced mixtures for production. Such mixtures should consist of home-grown oats, mixed corn, kibbled maize, or flaked maize for the carbohydrate part of the diet, strengthened with linseed cake meal, groundnut meal or soya bean meal to supply the protein, sweetened with molasses, flavoured with condiments, and fortified with a complete mineral mixture and vitamins. Overfeeding should be avoided. Nursing ewes get very hungry and are apt to gulp down the concentrate allowance, with consequent harmful effects; so regular, small feeds should be the aim.

As the weather improves with the lengthening days of spring, more and more reliance must be placed on new season's grass, of, say, S.22 Italian ryegrass or, in milder areas, H.1 ryegrass and first-year leys. Winter wheat which has become proud is a reliable alternative to grass at this time, and so is autumn-sown rye. Later on, a light grazing of forward winter oats can also add to the variety and amount of fresh green food for the flock. It is an advantage to provide creeps so that the lambs can take additional trough food, or to allow them to graze ahead of their mothers, for it is the tips of the new growth that are particularly nutritious for them.

In every possible way the lambs should be encouraged to suck, feed and rest, and although their incessant gambolling appears to be wasteful of energy, yet that playful exercise helps them to develop muscle which becomes the lean meat part of the joint at a later date.

Health Precautions Finally, a word about health. Sheep are noted for the many ills, ailments and accidents that befall them; just as they are also the most difficult animals to cure once they have become really ill. In the national flock of great Britain it has been estimated that over a million ewes, and even more young lambs, are lost every year.

Flock management on pasture and forage crops is still based on the historic practice of migration, whether it be on the Assyrian hills, on hafod and hendre, or from paddock to paddock and fold to fold. Taking precautions in the modern sense means making full use of inoculations, vaccines and dosages which modern science has made available to the shepherd. And, remember that at all times prevention is better than cure.

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DO BULK FOODS PRODUCE MILK?

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Bulk foods, replacing concentrates, can help considerably in the economic production of milk, but, as a recent survey in Gloucestershire showed, the standard of management must be high.

THERE is much talk today about increasing production from the resources of the farm itself and of substituting home-grown bulk foods, especially grass, for purchased concentrates. Some people go so far as to say that quite high yields of milk can be produced from bulk foods, and the term "forage farming" is becoming an accepted part of farming vocabulary. The question is—in what circumstances can bulk foods produce milk? And can they, in fact, do so consistently? Certainly such a saving of concentrates would be very welcome economically, but it is not an easy matter.

On a basis of chemical analysis and relative costs, both starch and protein equivalent can be grown on the farm as grazing, conserved grass or other forage, at much less cost than it can be obtained from either home-grown cereals or purchased balanced rations. But how far are the starch and protein in bulky foods efficient substitutes for concentrate foods in the production ration?

To obtain some actual information on feed substitution in practice, a survey was carried out in 1954-55 on some thirty Gloucestershire farms. A simple input and output record was made for one week in each of the four seasons of the year, food given to the cows being recorded from Monday morning until the following Sunday evening and set against the total output of milk. The data was collected in the months of March, May, July and November.

DO BULK FOODS PRODUCE MILK?

It became clear very early that few of the farmers had definite plans for utilizing bulky foods of hay, silage and kale, either for *maintenance* rations (which, in practice, usually means that kale and silage are used as alternatives to hay) or as a definite part of the milk *production* ration. When the results of the survey were analysed over the twelve months period, some startling facts emerged.

It is common in farming circles to talk of getting maintenance and the first two gallons of milk from kale and silage, and the first three, or even four, gallons off grass in the summer. But taking the average of these quarterly checks over the year, we found that grassland products, roots and green fodder had, in fact, produced maintenance and the first 2½ *quarts*—not 2½ *gallons*—a day over the whole year! In other words, about 3 lb of concentrates were being fed for every gallon produced at a yield level averaging 2½ gallons per cow per day. There was, as expected, a considerable variation from farm to farm. At one end of the scale, some farmers were feeding an average of 4 lb or more of cake for every gallon produced throughout the year, while the best result was an average of maintenance and the first two gallons over the whole year.

The following table gives details for the quarterly check periods, showing the average yield per cow, the average quantity produced from the farm, and the percentage of milk obtained from bulky foods:

	Average Yield per Cow	Produced from the Farm	Percentage of Milk from Bulky Food
	gal	*gal*	
March ...	2.5	—	—
May ...	2.9	1.9	65
July ...	2.4	1.3	54
November ...	2.3	—	—

The average yield for the whole year was just over 2½ gallons of milk per day for every cow in the herd, and 2.9 lb of concentrates were fed for every gallon produced. Put another way, 24 per cent of the total milk production was obtained from bulky foods (hay, silage, kale and grazing).

Comparison of Four Seasons Certain lessons can be learned from an examination of the results for the individual months. May was chosen as the first recording month to assess the position when the dairy herd would normally have been turned out to grass. In May 1954—admittedly an exceptionally cold month—the average yield per cow was 2.9 gallons and the average amount of concentrates fed was 1.5 lb per gallon. This works out at rather less than maintenance and the first two gallons off grass. A further item of the utmost significance which arose from the May recording week was the fact that nearly one-third of the recorded farms were feeding well over 2 lb of concentrates for every gallon produced. This item should be viewed against a background, on most of the farms, of a quite heavy expenditure on fertilizers for leys and permanent pasture.

The July check was made to study the effect of the decline in herbage quality as the season progressed. It must be borne in mind that July 1954 was a very wet and, consequently, a very grassy month. In that month the average yield per cow fell to 2.4 gallons and the quantity of concentrates fed rose to 1.8 lb per gallon. Over the whole field this represents maintenance and rather more than one gallon off grass, although there were a number of farms which were not achieving these figures. In one case no milk was being produced from grass at all, notwithstanding the fact that the dairy herd was grazing expensively nurtured, short-term leys.

The next recording period was November, which normally represents a month of full-scale winter feeding. In November 1954, the average yield per cow was 2.3 gallons, and the average ration was:

	lb
Hay	8
Hand-fed roots or green fodder	10
Concentrates	9.5
plus folded kale and some late autumn grazing	

This represents maintenance only off bulk feeding, and means that concentrates were being fed at the rate of 4 lb for every gallon produced.

The final check was made in March 1955. This month was chosen as reflecting the position at the end of the winter, when in a number of cases winter food supplies would normally be running out and the dairy herd could be expected to be feeling the seasonal effects. At that time the average yield was 2.5 gallons per cow, and the average ration being fed was:

	lb
Hay	15
Silage	30
Roots	10
Concentrates	11

This represents really full-scale concentrate feeding, with just over 4 lb of concentrates being fed for every gallon: the whole of the bulk detailed above merely produced maintenance.

The position in this month appeared to be even more extraordinary than at the time of the previous checks, and so some trouble was taken to analyse the figures on the farms which were feeding large quantities of silage and roots (fourteen in all). In these cases, the average March ration was:

	lb
Hay	10
Silage	50
Roots	20
Concentrates	10

According to accepted feeding standards, these bulk foods should have produced maintenance and, at the very least, the first gallon. The actual result was that the bulk foods only barely succeeded in providing for maintenance and *the first pint*!

Incidentally, it was assumed throughout the investigation that 4 lb of concentrates will produce 1 gallon of milk. We fully realize that the response rates are not necessarily so constant, especially at high yield levels.

Wastage in the Ration What are the conclusions to be learned from these results? First, it seems clear, on the basis of the results of milk costs investigations in Gloucestershire in pre-war days, that our standards of economic and nutritional efficiency today are very little better than they were twenty years ago, when our grasslands were largely semi-derelict. Twenty years ago, 3 lb of concentrates were being fed for every gallon of milk; today, in an era of high farming, the level of feeding is still the same, although admittedly with a higher output per cow and slightly higher rates of stocking per acre.

Secondly, high farming is a means of increasing the output of relatively less expensive home-grown foods but this, nevertheless, involves greater expenditure on fertilizers, cultivations and seeds, which may in fact increase the average costs per unit of home-grown nutrients. It seems clear from this

study that the anticipated results from this extra investment is not, by and large, being achieved and that, to a very large extent, part of the ration is being wasted.

Lastly, many farmers are failing to show the same efficiency in feeding these bulk foods as has been put into the growing of them, and a lack of purpose is apparent in many of the individual rations. The main causes of these disappointing results can, we think, be attributed to the following three factors:

1. Heavy feeding of stale cows to maintain output and prolong their lactation, sometimes in the interest of milk records.
2. The difficulties of assessing the current supplementary feed requirements of heavy yielding cows at grass in summer, together with the practice of making a small allocation to low yielders for the sake of peaceful co-existence at milking time.
3. The difficulties of smoothing out the seasonal supply of quality grazing during the summer, and of hay, silage and kale in the winter.

Much thought is needed regarding the use of bulky foods. Only a study of the individual farm can give the answer. It may well be that additional home-grown foods should be used to keep extra cows, sheep, or even beef cattle, rather than to pack them into dairy cows in an attempt to produce milk or to release land from milk production for cash cropping. In other words, are we to assume that the task of home-grown food under a wide range of conditions is merely to produce maintenance rations? We know it *is* possible to utilize bulk food efficiently for milk production, because there are several farms carrying high-yielding herds which, throughout the year, receive only 2 lb of concentrates for every gallon produced, and produce more than 50 per cent of the milk from bulky home-grown foods. What is abundantly clear, therefore—and this is surely the real lesson—is that efficient utilization requires a much higher standard of management than is generally being applied.

We should like to express our thanks to the farmers who co-operated with us in this survey, to Mr. S. R. Wragg, M.A., Senior Agricultural Economist at Bristol University, and to all those members of the N.A.A.S. staff in Gloucestershire who helped with the survey.

★ *NEXT MONTH*

Some articles of outstanding interest

Filling the Summer Gap in Grazing by T. E. Williams of the Grassland Research Institute ● **Formalin to Prevent Clotting in Skim Milk** by R. S. Barber, Dr. R. Braude and K. G. Mitchell of the National Institute for Research in Dairying ● **Our Cattle and our Grass** by Dr. John Pearce, University of Reading ● **Merchants' Credit** by Dr. B. E. Cracknell of the Ministry's Economics Division ● **Early Potatoes in Cornwall** by Dr. Katharine Johnstone, N.A.A.S. Cornwall.

RAGWORT AND ITS CONTROL

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Spraying with 2,4-D or MCPA is a useful alternative measure to the cultural control of ragwort. Applied at the right time, 2,4-D will kill the weed at all stages of its growth.

TO farmers, the objectionable characteristics of ragwort are threefold; it is poisonous, it reduces the production of useful herbage, and it is likely to spread to other people's land. It is because of these persistent and poisonous qualities that ragwort is scheduled as an injurious weed under the Corn Production Acts (Repeal) Act of 1921, and power is given under the Act to serve on the occupier of the land on which the weed is growing a notice in writing requiring him to "cut down or destroy the weed in the manner and within the time specified in the notice".

Ragwort (*Senecio jacobaea* L.) is native to Europe, North Africa and much of Western Asia and has been accidentally introduced into many countries. It is abundant throughout Great Britain and has been recorded from every county of England, Wales, Scotland and Northern Ireland. It is most commonly found on neglected or overgrazed pastures on all but the poorest soils, and on roadsides and waste ground. There are three main phases in its life cycle: first, the germination and establishment of the seedling; second, the formation and development of a rosette; and, lastly, flowering and seed production when conditions are suitable. The establishment of the seedlings is the weakest point in the life cycle, and mortality is invariably great because they are not strongly competitive. In fact, in vigorous swards they rarely become established. The rosette stage may often be indefinitely prolonged by cutting, trampling or other interference. Under these conditions, the plant may become branched and considerably enlarged, so that flowering, when it does occur, is exceedingly vigorous. If undisturbed the plant is often biennial and dies after flowering in its second year.

A considerable amount of seed is produced: up to 150,000 per plant have been recorded. These seeds are small and are dispersed by the wind when the weather is dry, but under damp conditions they are not shed because the seed-heads do not open. There is little information concerning the distance over which dispersal takes place, but in an experiment in New Zealand, where conditions were favourable, only 0.5 per cent of the seed was dispersed at all and the greatest distance recorded was 40 yards ([1]).

In Great Britain germination takes place mainly in the autumn or spring, but it may occur at any time if conditions are suitable. The seed may be shed from July until the first frosts, although chiefly in September and October. The seeds germinate very quickly under warm, moist conditions, but they can remain viable for several seasons if buried in the soil.

Seedings, however, are not always the most important method of propagation. The roots of established plants are capable of producing fresh shoots, especially when the aerial parts of the plant are killed or badly damaged. Isolated root fragments as short as one centimetre may produce shoots which are easily confused with true seedlings. These shoots may be more vigorous than seedlings and can lead to a rapid increase in population, even in well-managed grassland.

Although ragwort may increase very quickly, it may also die out and disappear between one year and another, even though there has been no apparent change in the environment. Sometimes this is due to a population

of uniform age reaching maturity at the same time, but several instances are known where seedlings, rosettes and flowering plants have all disappeared during the winter without apparent reason.

Ragwort is often associated with rabbits, since heavy grazing of a sward allows the seedlings to become established. A short-term effect on ragwort of the elimination of rabbits by myxomatosis has already been shown by The Nature Conservancy ([2]) to be that, under certain conditions, ragwort has flourished, due to its no longer being nibbled. Nevertheless, the long-term effect may well be a reduction, since the increased growth of other plants that have hitherto been heavily grazed will tend to limit the ragwort population.

Ragwort Poisoning Ragwort is rather unpalatable to cattle, but it may occasionally be grazed. There is, however, little danger, provided there is ample alternative herbage available. The plant is certainly not as dangerous in grassland as it is when incorporated in hay, silage or dried grass, where selective eating is impossible. The effects of ragwort poisoning are slow and cumulative, and by the time symptoms are apparent the animal is generally past recovery ([3]). Cattle and horses are particularly susceptible, but sheep are relatively tolerant: the latter can be grazed safely for short periods on fields infested with ragwort and, indeed, are commonly used as a method of controlling the weed. However, the sheep's degree of tolerance varies; old ewes are generally considered to be the least susceptible. Susceptibility also varies amongst cattle; in Wales, the heaviest losses are reported in animals under two years old ([4]).

The symptoms which become apparent after the animal has eaten ragwort for several weeks are described in two publications of the Ministry of Agriculture ([5, 6]). There is little information concerning sub-lethal ragwort poisoning, which might well cause reduction in growth or milk production.

Chemical Control Chemical control of ragwort, using a wide range of herbicides in spray form, has been attempted for many years. During the last eight years a large number of experiments have been carried out by the A.R.C. Unit of Experimental Agronomy, in co-operation with the National Agricultural Advisory Service, and much light has been shed on the factors that may influence the results of spraying. By far the most effective herbicides have been the synthetic plant growth-regulators 2,4-D and MCPA, and the earlier experiments showed that both can kill seedlings, rosettes and the aerial parts of flowering plants when sprayed at dosages of 1½-2 lb per acre. Generally, 2,4-D was found to be slightly more effective than MCPA ([7]). Commercial spraying of ragwort has, however, given variable results; and even where a good initial kill has been obtained, rapid reinfestation has often followed.

During 1952-53 twenty experiments were carried out in England and Wales comparing varying dosages of 2,4-D (amine), applied in 6, 40 and 80 gallons of spray solution per acre, when the flowering shoots were in the young bud to full flower stage. The results, which have been reported elsewhere ([8]), indicated that:

1. Complete suppression of flowering shoots occurs a year after spraying with 2,4-D at dosages of 1-4 lb per acre.
2. There is no important difference between the effects of spraying at high, medium or low volume.
3. The effect of the treatment on the flowering shoots during the month after spraying may vary greatly, making it clear that the initial effect on the flowering shoots cannot be regarded as an indication of the long-term results of the treatment.

Three additional experiments were carried out during 1953-54 to compare the toxicity of an ester derivative of 2,4-D with that of the amine used in the

1952 experiments, and to see whether the addition of a wetting agent affected the effectiveness of the spray. The overall results were similar to those of the previous experiments. The ester gave a significantly greater kill of flowering shoots in the year of treatment than the amine in one of the three experiments, but a year later all treatments in all experiments had resulted in virtually complete suppression of flowering, even with the lowest dose of ½ lb per acre. The ester and the amine gave similar results on the non-flowering plants and no effect was observed from the addition of a wetting agent to the spray.

Of the variable results on flowering shoots, some would have been considered a failure commercially, and, indeed, farmers have in the past sometimes been compelled to cut the flowering stems after spraying to comply with the law. Previous work by the Unit had shown that spraying should take place before the flowers had opened, but there was little information concerning the importance of the precise timing of the application in relation to the kill of the flowering stems. Five experiments were therefore carried out during 1954-55, comparing 2,4-D (amine) at three application times.

Table 1

Percentage Mortality of Flowering Shoots of Ragwort in the Year of Treatment after Spraying with 2,4-D (amine)

Mean of three replicates and three doses (¾, 1½ and 3 lb per acre)

STAGE OF GROWTH	LOCATION OF EXPERIMENT				
	Hants	Hereford	Glos	Wilts	Leics
Beginning of shooting to appearance of flower-buds	74	84	92	88	96
Early bud stage	87	68	58	66	89
Late bud stage	54	—	30	—	81
Early flowering stage	—	16	—	49	—

From Table 1, which shows the percentage mortality of flowering shoots during the months immediately following spraying, it can be seen that the earlier treatments were much more effective than those later ones in killing the flowering shoots. In only one experiment out of five (the earliest to be sprayed) did the first application not prove the most effective. Estimates of viable seed produced by plants surviving the chemical treatments showed that the earlier applications were also the most effective in reducing seed production (Table 2).

Table 2

Yields of Viable Ragwort Seed from Plants Surviving Treatment with 2,4-D (amine) in the Year of Spraying

Mean of three experiments

Approximate Stage of Growth of Flowering Shoots	2,4-D *lb/acre*	Seed Yield per Acre in Millions *Total*	*Viable*
Beginning of shooting to appearance of flower-buds	¾	20	12
	1½	3.9	1.6
	3	0	0
Early bud stage	¾	96	83
	1½	1.8	0.7
	3	1.4	0.3
Late bud stage to early flowering ...	¾	830	510
	1½	360	130
	3	100	12
Unsprayed plants		1,320	1,080

Re-establishment after Spraying The relative importance of ragwort re-establishing itself by seedlings or root fragments following spraying is not fully understood. It is known that the seedlings do not easily become established in a close sward, and it is reasonable to assume that regeneration from root fragments is likely to be the more important under such conditions. On waste land, or on poor grassland with

an incomplete grass cover, both methods of regeneration probably occur, particularly if the plants have been cut over or trampled on. When regeneration is from root fragments only, two correctly timed applications of MCPA or 2,4-D should eliminate the weed and, provided the grassland management favours a close and competitive sward, it should not reappear. When, however, seedling reinfestation occurs, it is unlikely that a second spraying made in the following autumn or spring will have a lasting effect, because of viable seed present in the soil. Repeat sprayings at suitable intervals will presumably eliminate the source of seedlings in due course, provided fresh seed is not reaching the area. When considering repeat sprayings in grassland, it should not be overlooked that they are likely to be harmful to any clover present in the sward.

Before leaving the subject of chemical control, it should be emphasized that treatment with MCPA and 2,4-D may cause ragwort to become more palatable to stock. Grazing is unlikely to take place if alternative herbage is available, but the risk is nevertheless a real one, and it is advisable to keep stock away from the field for several weeks after it has been sprayed.

Alternative Methods of Control The most common control measure for ragwort is to mow the flowering shoots. This is, at best, a short-term expedient for preventing seed production and dispersal on to nearby land. Not only will the plants be encouraged to perennate, or persist, but the cut shoots may still produce viable seed, unless carted off the field and destroyed; furthermore, there may be a second crop of stems to be dealt with in the autumn.

Pulling individual plants is occasionally recommended to control light infestations, but this is unlikely to eradicate the weed because however carefully the plants are pulled up, it is inevitable that roots will be left in the soil and regeneration may occur.

The most effective method of cultural control is to plough up the land and to introduce an arable rotation before sowing down again to grass under a cover crop. Direct reseeding often leads to rapid reinfestation. Good grazing management and adequate manuring will go a long way towards preventing ragwort getting into an established ley; the presence of clover and adequate available phosphate have been shown by Dr. J. L. Harper of the Department of Agriculture, Oxford University, to discourage ragwort establishment. Sheep grazing and hay crops can both contribute to ragwort suppression, and there is striking evidence of this from Wales ([4]). *Hay or silage containing ragwort cannot, however, be fed to cattle with safety.*

Conclusion Ragwort can live under a wide range of conditions. No single control measure is likely to prove effective in all situations, and therefore a flexible outlook should be maintained by farmers and landowners troubled with this weed and by those responsible for seeing that the legal requirements are satisfied. A high standard of farming will do much to prevent ragwort from becoming a problem, but there are many occasions when control is required and a change in management is not feasible. Under these conditions, spraying with 2,4-D or MCPA is undoubtedly the most useful measure available and is definitely better than cutting or pulling. The experiments mentioned in this article have clearly demonstrated that 2,4-D applied at the correct time can kill ragwort at all the various stages of its growth—seedlings, shoots from root fragments, young rosettes, perennating rosettes and flowering plants—and prevent flowering during the year after spraying. Any young plants reinfesting the area can be killed by further applications.

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BRASSICA VIRUS DISEASES

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This article explains why the incidence of the three most common brassica virus diseases varies from year to year, and discusses the measures which farmers can take to prevent a serious outbreak.

THERE are three important virus diseases of brassica crops in Britain—Cauliflower Mosaic, Cabbage Black Ring Spot, and Turnip Yellow Mosaic. Cauliflower Mosaic virus is usually more widespread than the others, and on two occasions, during the early 1940s and again during the years 1948-50, this virus became epidemic, making broccoli crops in many parts of the country unsaleable. Though Cauliflower Mosaic and Cabbage Black Ring Spot have been serious in some areas since 1950, their incidence over the country as a whole declined steadily until the autumn of 1955, when Mosaic again became prevalent. Should conditions favour its spread this spring, another serious outbreak could easily develop.

These two diseases have been known since 1935, but Turnip Yellow Mosaic was first described in 1946 as occasionally infecting turnips in Scotland. In 1952 a strain of this virus became prevalent in Northumberland and Durham, causing serious losses in cauliflower, cabbage, Brussels sprouts and kale crops, and spreading over a wider area each year.

Spread by Insects An epidemic can only develop when the sources of virus and susceptible host plants are scattered widely throughout the country and there is some effective way in which the virus can pass from diseased to healthy plants. The increased cultivation of brassicas during and after the war may have contributed to the recent epidemics, for the virus will spread more quickly and extensively when the acreages are increased and crops are close to each other. The total acreage under brassica crops in England and Wales increased by one-half from 1939 to 1947, and the acreage of horticultural brassicas, such as cauliflowers and

Brussels sprouts, was doubled. A lot more brassicas were also grown in gardens and allotments, especially during the war.

Cauliflower Mosaic and Cabbage Black Ring Spot viruses are both spread by aphids, especially by the Mealy Cabbage aphid and the Peach-Potato aphid. The Mealy Cabbage aphid overwinters as eggs on the stalks of brassica plants, though in the south and west some also overwinter as living aphids. Many are destroyed when the remains of crops are burned or ploughed under, and others are killed by severe weather, but a proportion always survive to give rise to small colonies, from which a few winged insects fly to new hosts during May and June. There they multiply, and in warm, dry summers very many winged aphids may be moving within the crops and from one crop to another during late July and August. They continue to develop and fly until cold weather stops them in November.

The Peach-Potato aphid lives on many more hosts than the Mealy Cabbage aphid. It overwinters in England mainly as living insects on plants such as brassicas, lettuce and spinach, in mangold clamps, or in glasshouses, but it may also overwinter as eggs on peach and some related trees. It is usually more numerous than the Mealy Cabbage aphid in spring, and during the summer it infests many different crops, but particularly potatoes and turnips.

The numbers of both species depend largely upon the weather. They increase most in warm, dry weather, and more survive in mild than hard winters. Populations develop faster in the warmer south of Britain than in the north, but the warmest parts do not always have the largest populations because another factor is important in affecting their size—the prevalence of parasites and predators. Whenever aphids are numerous, their predators and parasites also increase in number, but after the aphid populations decrease, most of their enemies die for lack of food. The aphid populations can then increase again rapidly. Thus plagues of aphids develop as a result of combinations of favourable weather and absence of predators—conditions which rarely occur for two consecutive years.

The Peach-Potato aphid was unusually abundant during the springs of 1948 and 1949, but was scarce during those summers because predators and parasites were plentiful and active. The Mealy Cabbage aphid was exceptionally numerous in 1947 and again in 1949 in most parts of the country. Thus large numbers of aphids, of either one or both species, existed to spread the virus diseases when they were last epidemic.

The strain of Turnip Yellow Mosaic virus which has become prevalent in the north-east of England since 1952 is transmitted by flea beetles, not by aphids, and it became widespread during the 1952 epidemic of flea beetles. Flea beetles are not so mobile as aphids, and this disease is still confined to Northumberland and Durham, but unless it is eradicated it may ultimately spread throughout the country.

Differing Effects on Plants The viruses cause different effects in different kinds of plants. Turnip Yellow Mosaic and Cauliflower Mosaic viruses are confined mainly to cruciferous plants, but Cabbage Black Ring Spot virus can infect plants of many different families. Turnip Yellow Mosaic usually causes large, yellow-green blotches on the leaves, and infected plants often die during severe weather.

The first sign of infection with Cauliflower Mosaic virus in most plants is that the network of veins in the leaf shows up more clearly than in normal leaves; leaves that develop later have bands of green along each side of the veins, with mottled areas between. This virus severely affects summer and winter cauliflowers, and plants that are infected when they are young rarely produce marketable curds. Turnips are sometimes killed; rape and mustard

survive, but are crippled; cabbages and kale are less affected, and produce plants of a moderate size.

Cabbage Black Ring Spot is usually less prevalent than Cauliflower Mosaic, because aphids cannot pick it up and retain it so readily. It can affect cabbages, Brussels sprouts, turnips and mustard severely, but it has less effect on kale and cauliflower. The symptoms in most host plants show as localized spots on the leaves, sometimes pale green or yellow but often becoming black and dying in the centre.

The time between infection and symptoms appearing varies with the rate at which plants are growing. During the summer, symptoms may show in seedlings three or four weeks after infection, but plants infected in the autumn often show no symptoms until growth begins again in the spring. This explains the "flush" of Cauliflower Mosaic symptoms often noticed by growers in broccoli crops during March.

Sources of Virus The viruses are not seedborne; seedlings start life free from them and become infected only when insects bring them from other plants. Insects move little during the winter, and the spread occurs mostly between April and October. In districts where most of the brassica crops are harvested during the winter, there are few sources of virus in the spring, and the diseases are scarce. Examples of such districts are the broccoli-growing areas of Cornwall and areas where the only brassica crops are cabbage or kale for cattle food. No evidence has been obtained to suggest that weeds play any significant part as sources of virus, though many cruciferous weeds, such as charlock and shepherd's purse, are susceptible to them.

The story is very different in market-garden districts, or in the north, where late-maturing broccoli is grown. Here, insects can easily transfer virus from the old crops to the young. Some crops, such as most varieties of cabbage, which are not severely affected by Cauliflower Mosaic virus, may become the supply source of virus for crops like cauliflower, which are severely affected.

The longer a plant is alive, the more chance it has of becoming infected, and the more danger it is to its neighbours. Cauliflower seed crops, for instance, are sown in April but mature during the late summer of the following year. They often become infected during their first season of growth and then, during their second year, form a source of both aphids and virus from which the young plants of the new season's crop may become infected.

After a severe winter, aphids may be scarce in spring, as they were in 1953 and 1954; overwintering crops may then be cleared before aphids develop to carry virus to the new seedbeds and young crops. However, when aphids are numerous in spring, as they were in 1948 and 1949, and when infected crops are still in the field, virus will almost certainly be carried to seedbeds in the district.

Plants infected as seedlings not only suffer more than those to which the disease is carried later, but after transplanting they act as sources from which virus is spread by insects within the crop. A crop transplanted with as few as one in two hundred of the seedlings infected may have 20-40 per cent of the plants suffering from a virus disease at harvest. Under similar conditions, the more seedlings that are infected when transplanted, the greater will be the final incidence of disease.

Protecting the Crop It has already been explained that the three viruses are spread by insects. Can they, then, be controlled by insecticides? Cauliflower Mosaic and Cabbage Black Ring Spot viruses

can be picked up and transmitted in a few minutes, and none of the insecticides known at present can kill visiting winged aphids quickly enough to prevent them acting as carriers. Repeated spraying with insecticides has failed to protect healthy plants from infection, but this does not mean that insecticides have no part to play, for they can be used to prevent aphids developing on the old infected crops. Unfortunately, although most growers are willing to spray the crop they wish to protect, few are keen to spray those they have almost finished with, although this is the only way to prevent the disastrous mass movements of winged aphids. And since seed plants are often infected, every seed-grower should keep his plants treated with insecticide to prevent aphids from developing on them.

The aim of every grower should be to prevent, so far as he can, virus being carried into his seedbeds. Fortunately, there are several ways in which the number of infected seedlings can be kept low, even where disease is prevalent.

Isolation of Seedbeds. Seedbeds should never be sown next to old standing crops, or near allotments or gardens. Few growers can site them some miles from other brassicas, but as much isolation as possible should be sought.

Barrier Crops. If seedbeds have to be sown within a few hundred yards of infected crops, a barrier, consisting of two or three rows of cereals drilled around the seedbed, will reduce the number of infected plants to about one-fifth of those in unprotected beds. This is because most of the incoming aphids then alight on the immune cereal (barley or oats sown a week or two before the brassica seed have proved satisfactory), and then fly upwards and over the seedbed. The barrier will protect a bed up to twelve rows wide. If wider beds are being sown, strips of cereal should be drilled at intervals of twelve rows; if the beds are long, a few single rows of cereal should be drilled at intervals across them.

Density of Plants. The number of plants that become infected in the seedbed depends upon the number of infective aphids that alight in it, for normally there is no time for much spread from plant to plant within the seedbed. The more plants there are in the bed, the smaller will be the percentage infected, so the rows should be as close together and as densely sown as is compatible with the production of sturdy seedlings.

Selection of Seedlings. The outer rows of an unprotected seedbed are likely to contain a greater proportion of infected plants than the rest, because aphids usually alight first on the outside plants. The biggest plants are also the most likely to be infected, so extra-large seedlings should be discarded, as should any whose health is doubtful.

Just as seed should not be sown near infected plants, so seedlings should not be transplanted to land near old, maturing brassicas. Intervening crops, immune from the viruses, will often give some protection: the aphids may stay on them, or lose their infectivity while feeding, or fly off elsewhere.

Varietal Susceptibility Growers can also reduce losses from virus disease to some extent by growing varieties that tolerate infection. Both summer and winter varieties of cauliflower, as well as other brassicas, vary considerably in their tolerance. For example, Majestic, Satisfaction and Late Feltham are very intolerant, whereas All the Year Round, Continuity and St. George tolerate Cauliflower Mosaic virus with only moderate loss. Slight differences in susceptibility to infection also occur, so there is hope that future breeding and selection may produce new varieties which will be more resistant than those commonly grown today.

BALED SILAGE

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The convenience of baled silage for winter feeding is persuading more and more farmers to turn to this method. Dr. Murdoch briefly examines some of the advantages and disadvantages in its making.

THE use of a pick-up baler in silage-making was first reported in this country in 1950, and since then an increasing number of farmers have made silage in this way. There is a prevailing opinion amongst farmers who have used this technique that baling is easier than other methods of making silage, and that their men prefer it. There is no doubt that under certain circumstances baling can be very useful: it is economical when silage has to be carted over a long distance, it entails less heavy work and, possibly, a smaller labour force than is required with a greencrop loader. There are several instances of baled silage being made successfully on farms where only two men were available, and when many other methods of silage-making would have been impracticable because of the distance of the silo from the field where the crop was being cut. It is unlikely, however, that baling will compare favourably with buck-raking on short hauls, either in ease of handling or labour needs.

Much of the success in making baled silage is due to the fairly mature condition of the herbage, since normally no additive is required. It should be emphasized that baling is only a *method* of handling the crop: it has no effect on the fermentation of the product. It may be possible to control the temperature in the silage to some extent by allowing the bales to heat up in the field, but usually the difficulty is to get the bales into the silo before excessive heating takes place. With wet herbage, it is probably advantageous to have this temperature rise in the bales, but with dry or fairly mature material any great time-lag between baling and carting should be avoided. Generally, it is advisable to avoid cutting or baling more of the crop than can be carted the same day.

Some Disadvantages . . . One of the main disadvantages of baling is that it is almost impossible to use molasses as an additive. It is obviously out of the question to apply the molasses on the baler, and it is very doubtful if it is worth while applying it at the silo, since only the outside of the bales would benefit. If legumes or high protein grass are being ensiled, the only alternatives are wilting the herbage before baling, or using sodium metabisulphite. When wilted herbage is used it is important that it should not be over-dry; otherwise it will be difficult to bale. But up to this point, the drier the herbage the better will be the quality of the silage. If the crop is wilted, good consolidation is of the utmost importance, as an overheated silage can readily result from this type of herbage. It is possible to use metabisulphite with a baler by mounting an applicator on the baler. When mechanically applied in this way, the metabisulphite is evenly distributed throughout the herbage, and is therefore given the best conditions for its action.

A most surprising fact about the use of a pick-up baler for silage is that there appears to be little wear and tear on the baler. Wet grass, especially, will go through the baler very smoothly, the moisture providing a form of lubrication. But the baler will deteriorate if moisture from the herbage is left on it, and it is a wise precaution to run some straw through the baler at the end of a day's work.

Certain modifications are necessary to a baler which is to be used for silage, and some of these are referred to below. It is difficult, however, to include all the adaptations which have to be made for the different types of baler, and farmers are strongly advised to consult the manufacturers of their machine to find out the recommended modifications. The cost of modifying a baler is not high—certainly not more than £10—but it varies widely, depending on type.

A full-size bale of herbage is both heavy and unwieldy, and it is essential, therefore, to modify the baler to make half-size bales. The weight of these bales will depend on the moisture content of the crop and the pressure in the bale chamber, but normally it will be between 50 and 70 lb. In balers having an auger feed into the bale chamber, it is usually necessary to spring-load the auger to give greater pressure on the herbage, otherwise there will constantly be blockages. It is also advisable with some balers to have bottom and top plates in the bale chamber, especially when baling short material, as the herbage tends to bulge out and continued pressure will buckle the chamber.

. . . and Advantages Among the several advantages that can be claimed for baling over other methods of harvesting a crop for ensilage, is the ease with which the bales can be taken out of the silo in winter. If the bales are properly packed, it should be easy to remove them from the silo with the strings intact, and no cutting out should be required. The string will rot, however, if it is exposed to the air, and unless the sides and top of the bale are properly sealed, a number of them will be broken in the silo.

Another advantage is that by using a bale counter an estimate of the quantity of herbage available for feeding during the winter can very readily be made. It must be remembered, of course, that there is some loss of nutrients in silage, and therefore, say, 25 per cent should be deducted from the initial total quantity to assess the final figure. Silage in baled form is handy when rationing stock, but it is important to realize that there is a considerable variation in the weight of the bales. Thus rationing may not be as accurate as might at first be supposed.

One of the main attractions of this method is that many farmers now have a pick-up baler on the farm, which, if used for silage-making, avoids the need for further expense in buying silage machinery and cuts down idle hours. One rather doubtful advantage is the possibility of baling silage on a contract basis. For a small farmer with little labour, this might well be a solution to his problem of silage-making, but there is always the difficulty in contract work of having the equipment at the right time.

There are conflicting reports on the cost of baled silage, and there is a wide variation in the results from surveys. In some instances, the economics of baling compare favourably with alternative methods of harvesting crops for ensilage, but in others it is shown to be a very expensive method. In general, it appears that baling costs are much the same as those for greencrop loading, and possibly for buck-raking when the silage has to be carted a long way, but the buck-rake is undoubtedly the cheapest on short hauls.

Photos : *N.I.R.D.*

Baled silage at the National Institute for Research in Dairying. Special care is necessary to ensure even, tight packing in the silo.

Photos : *F. B. Oates*

Mole-infested pasture at Haddon Hall, Derbyshire.
The mole breaks surface.

Mole icle on pp. 79-82)

Photos : *F. B. Oates*

The poisoned bait is prepared and (inset) dropped into the run.
Four kinds of mole traps in use today.

Dutch Auction (Article on pp. 76-9)

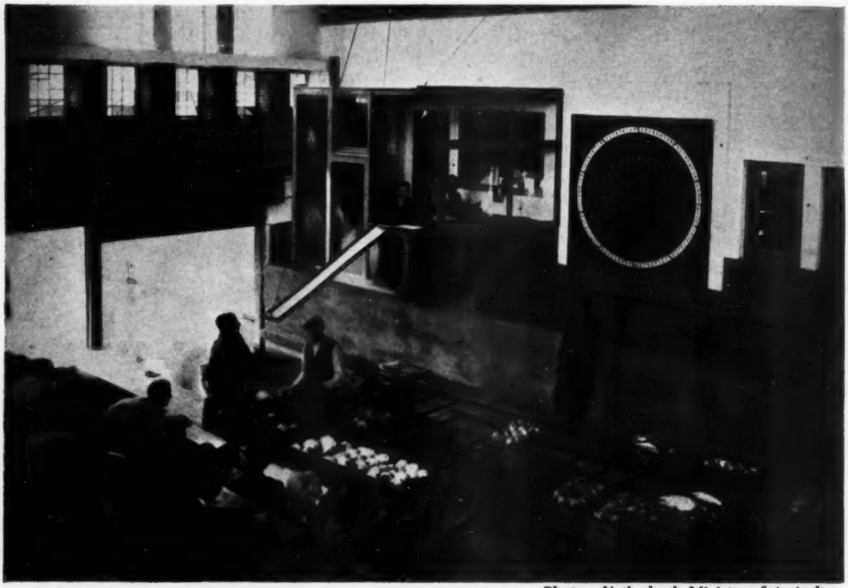

Photo : *Netherlands Ministry of Agriculture*

One of the 175 Dutch horticultural marketing centres.

Fire on the Farm (Article on pp. 83-4)

Photo : *John Leng*

Fire destroyed all but two of the twenty-five ricks built beside this road.

No Easy Road to Success On the practical side of silage baling, several features have become evident in the last few years, and an attempt is made to summarize them in the remainder of this article. Experience has shown that it is often an advantage when baling to have double swath-boards on the mower, especially when a heavy crop is being cut. With very light crops, it may be helpful to side-rake two swaths into one, but this should not be attempted with a heavy crop. The baler will usually pick up the herbage better if it follows the same direction as the mower.

The main complaint against baling is the difficulty of handling the bales in the field. No easy way of doing this has been devised, and it is usually necessary to have two or three men loading the bales. Where labour is scarce, a bale sledge can sometimes be used behind the baler to drop the bales in groups and so facilitate picking up. Low-loading trailers are obviously valuable here, and should be used wherever possible.

Silage-making with a baler is no easy road to success; it requires as much care as other methods. Special attention must be given when packing the bales into the silo, and it is worth noting that only container silos—either a pit or a walled clamp—are really suitable for baled silage. The bales should be placed so that the strings are running transversely across the silo and facing upwards.

Building of the bales should start at the sides of the silo, always working towards the centre, and they should be placed as tightly as possible against each other. A rather larger bale than is apparently required should be used to fill the space remaining in the centre, and it can be fitted in by slightly tilting the bales on either side. The bales in one layer should not appreciably overlap those in the layer beneath; otherwise it will be difficult to remove them in winter without exposing a large surface of silage. If some bonding is thought to be necessary, the overlap should not be more than three or four inches. It is possible to place the bales one on top of the other and still eliminate air spaces. Or the bales may be built in blocks 6-8 feet wide.

All air pockets must be eliminated from between the bales, otherwise bad patches of silage will result. The bales must be well packed into the silo, and this should be followed by good consolidation. In spite of the compression in the baler, the bales will heat up, and therefore the temperature in the silage should be checked with a thermometer from time to time. The rise in temperature will depend on the type of crop and the moisture content, and it is impossible to lay down hard and fast rules on consolidation. A certain rise in temperature is useful as a guide to the fermentation going on in the silage, but it should not be allowed to rise above 120°F.

There may be some difficulty in consolidating with wheeled tractors, as the front wheels can slip between the bales. This can be overcome by reversing the tractor on to the silage and consolidating with the rear wheels before running over it in the normal manner. An alternative method of dealing with this problem is to put a tarpaulin or planks over the bales for the initial consolidation. Although some farmers have made good silage without tractor consolidation until the bales were seven or eight layers high, it is usually better to roll every layer and consolidate well after every three or four layers.

A soil or chalk seal always reduces the waste on top of the silage, because the weight prevents overheating and mould development in the top layers. This is as true of baled silage as ordinary silage, and it is always worth the cost to have a seal, especially if the silo is small and the farmer has only a restricted quantity of silage available for winter feed.

DUTCH AUCTION

The co-operative spirit in trading is nowhere better exemplified than in Holland's system of auction markets for the entire output of her fruit, flowers and vegetables.

IF you were to find yourself in Rotterdam—or any other good-sized town in the Netherlands—around five o'clock some morning, you would witness a scene that has no counterpart anywhere else in the world. At that hour Holland's horticultural auctions are getting under way. The canals are filled with barges laden with fresh vegetables, fruit, and flowers. The streets are jammed with trucks, wagons, and pushcarts. And all of them are converging upon a large hangarlike building. But it is what goes on in that building that makes Holland's marketing system unique.

All Dutch horticultural growers sell their produce by auction—and by the clock. Not an ordinary clock either, but one that runs backwards, for the Dutch auction system reverses the usual procedure, in that the asking price is always higher than the final bid.

Thus the first thing you would see upon entering a Dutch auction would be a tremendous clock on the wall above the auctioneer's head, the dial divided into 100 units. On the face are as many numbers as there are seats in the hall. Facing the clock are seats raised in tiers like the dress circle of a theatre; each seat is numbered and equipped with an electric push button connected with the clock, and also an outside telephone. These seats are rented by exporters, wholesalers, and retailers, all of whom must lodge either cash or a banker's guarantee to cover their anticipated purchases before they are allowed in the hall.

When the auction is ready to start the first auctioneer announces the kind of produce and the grade; the second auctioneer announces whether the bidding will be in guilders or cents, and if for the lot or per piece. Sample lots of the produce then pass along under the clock on a conveyor—or on the barges themselves if the hall is adjacent to a canal. Some halls have large display rooms where buyers inspect the produce and jot down the lot numbers they are interested in. In this case, samples are not usually brought into the hall, and the auction proceeds at a faster pace, frequently with as many as ten sales per minute.

To start the bidding, the pointer on the clock is set a few points above the average price for the type of produce being sold. Then it starts moving backwards. When it reaches the price which the bidder is prepared to pay, he presses his electric push button, the clock stops, and the number of his seat lights up on the dial, thus showing his identity to the auctioneer. By this system, two or more bids can never clash since all other buttons are automatically disconnected by the first contact. The buyer's name is then recorded, together with the quantity of produce he bought, and after he has paid the cashier he may take possession of his purchase. However, if the buyer is uncertain of the price he wants to pay, all he has to do is pick up the telephone at his seat in order to keep himself informed of fluctuations in other markets.

How the System Began How the auction system started can be traced back to a somewhat insignificant occurrence in 1887, when the horticultural industry in the Netherlands was at its lowest ebb. The story is told that one morning a grower arrived with his barge loaded

with cauliflower and cabbage at the quay of the inland harbour of Brock-Op-Langendijk, a centre of cabbage production in northern Holland. Normally the quay would have been filled with growers, since it served as the general produce market, but on this morning the farmer with his bargeload of vegetables was the only one to arrive. Immediately he was surrounded by buyers and commission agents, all trying to buy his produce. A passing bargeman suggested that he sell the bargeload by auction—which he did, with most gratifying results.

Naturally this little cabbage and cauliflower auction did not transform Dutch marketing methods overnight, but from this tiny beginning developed Holland's national system of auction markets. By 1900 there were several auction associations throughout the country, and during World War I, when Dutch produce was in great demand, the auctions developed rapidly. Today almost the entire country is served by a network of auction markets, numbering some 175 and handling the entire national output of fruits, vegetables, flowers, and a portion of the bulbs, as well as those horticultural products that Holland imports.

These auctions vary in size and type. Some are classified by the produce they handle—that is, vegetables, fruit, flower, or bulb auctions. Others specialize in the export trade, and as a rule are to be found in the highly concentrated horticultural areas. The so-called consumption markets are, as one would expect, in or near the large towns, while the import auctions are located at the overseas shipping ports. But those classifications are not absolute; nearly every auction has a mixed character, with one or sometimes two groups of produce predominating. Similarly, in practically all auctions, even in those designed for export traffic, some 20 per cent of the buying will be for the retail trade.

Very few of the auctions are privately owned; most are owned by co-operative groups. Practically all, however, belong to the Central Bureau of Horticultural Auction Marts, which sets up standards for the industry and holds a benevolent umbrella over the head of the Dutch grower.

To anyone not familiar with the Dutch auction system, two questions naturally arise: first, how are the auctions organized and financed; and second, what are their advantages that a grower will voluntarily give up the independent control of his produce—as indeed he must under this system—and submit to group discipline.

How the Auctions are Organized The Dutch auction associations, as they are called, are organized much like any other co-operative, in that they are controlled and financed by the members themselves. When a grower joins an auction he obliges himself to send all his produce to that auction for a year, when he may change auctions if he wishes, but again he must bind himself for another twelve months. His total acreage of vegetables, flowers, and glass is strictly limited, although the acreage of his individual crops is not fixed. In return, the association inspects and grades his produce; rents him uniform, returnable containers at a nominal fee which he shares with the buyer—though this practice is gradually being supplanted by the use of cartons. The association supplies the auction facilities as well as the personnel to handle the produce and conduct the auction, and in the case of the larger auctions, provides storage rooms and packing sheds in the vicinity of the auction hall.

The financing of all this is relatively simple. A large part of the auction association's revenue comes from the rental of seats in the auction halls. The remainder comes from the growers themselves. To join an auction, a

grower pays a small membership fee. His main contribution, however, comes from the small percentage—2 to 3.5 per cent—which is deducted from each sale. Growers are paid weekly, though generally the amount of each grower's sales, minus this percentage for market service, is transferred to his account in his co-operative bank. These banks, incidentally, were started in 1895 by the growers themselves, and have had considerable influence on the growth of the auction markets. In fact, when capital is required for buildings and other facilities it is usually raised from these banks, with the members of the auction assuming liability for their portion of the loan on the basis of their individual turnover.

In a general sense, the main advantage of the auction system for the Dutch grower is that it brought order out of the chaotic situation that had existed previously when the grower not only had to cultivate his holding but to pack and dispose of his produce as best he might. Actually, there were malpractices on both sides. Some dealers took advantage of their position to the detriment of the grower's interests, while growers often delivered produce far below standard, particularly when demand was good.

Today the individual grower is no longer working in the dark but is assured of receiving the price his product is worth at the time of the sale. This is especially important when dealing with perishable goods where the grower cannot wait for prices to stabilize before selling. As for the buyer, the advantage of quality control, exercised by the auction associations in checking and grading the goods to be sold, more than compensates him for any quick profits he might make on a non-organized market.

Minimum Price Insurance Yet most important for the grower is the minimum price policy adopted by the Central Bureau in 1948. Briefly, here is how it works. Every grower pays a certain amount as a premium, which is deducted from his earnings on everything he sells through auction. This commodity levy, which varies from 1 to 5 per cent, depending upon the commodity and the season, goes into different commodity funds, which in turn are used to compensate growers for unsold produce. Each commodity fund is separate and individually financed, in order to avoid one crop subsidizing another.

The mechanics of this policy are based on the minimum price for each commodity, which has been worked out by the Central Bureau and is always below the cost of production. If this were not so the system would not work; producers could grow simply to gain the compensation price. At an auction when the bidding reaches this minimum price the clock is stopped. The produce not sold is either processed or destroyed, and the grower of the unsold produce receives a compensation price, usually about 80 per cent of the minimum price, but, in the case of highly speculative produce, sometimes as low as 50 per cent. The reasons for this difference between the minimum price and the compensation are partly to build up reserves, partly to gain funds to finance processing methods, and partly because the unsold produce is not generally of as high a quality as the goods sold at or above the minimum price.

The value of the minimum price scheme to Dutch horticulture has been immense, and has enabled the industry to put its own house in order without seeking government help. But it can serve only as a cushion against sudden temporary gluts or decreasing demand. It cannot control general economic tendencies or counteract fluctuations in international trade.

Besides administering the insurance fund, the Central Bureau serves the members in other ways. In 1947 it established a sales promotion fund which, by a very small levy on turnover, permits the Bureau to publicize Dutch

products both in the domestic and export markets. On two occasions this fund made it possible to finance exports to Germany when inability to arrive at suitable financial agreements with the authorities threatened the marketing of the crops.

Finally, no survey of the Dutch auction system should fail to mention the very foundation of its success, namely, the co-operative spirit among the growers and their willingness to accept controls, without which the system could not function. Perhaps if Holland had not been so dependent upon its exports the incentive to impose this self-discipline would not have existed. But forced by circumstances to put the marketing of its horticultural produce on a sound basis, the Netherlands has evolved a system which, for Dutch horticulture, seems eminently satisfactory.

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MENACE OF THE MOLE

F. B. Oates

County Pests Officer, Derbyshire Agricultural Executive Committee

The mole, although essentially an insect-eater, is a menace to agriculture, because of its habit of tunnelling under growing crops, throwing up heaps of soil on grassland and destroying earthworms. Trapping and poisoning are recommended to keep the population down.

THAT interesting little animal, the mole, belongs to the very large order of Insectivora, or insect-eaters, which comprises many different families throughout the world. But the true moles constitute a very distinct family within the main group. One of the first things immediately obvious on handling a mole is the way it is adapted for an underground life. The body is more or less cylindrical and its limbs are very short. In fact, perhaps the most distinctive feature of the mole is its shovel-like fore-limbs. To give added power to the front legs, on which the mole's very existence depends, there has been some adaptation of the bone structure differing from anything to be found amongst other mammals. In contrast, the hind feet are much smaller and are used mainly for pushing the mole along the tunnel excavated by the fore-limbs.

There is a widely held, but completely erroneous, belief that the mole is blind. It is true that of all the mole's senses, sight is the least developed, but it has been shown that the mole's eyes, primitive as they may appear, and apparently serving little purpose in the mole's way of life, nevertheless provide some vision—at least sufficient to distinguish between light and dark. The eyes are, in fact, set very deeply and can be seen only with some difficulty by separating the covering fur.

The mole has no external ears, but its sense of hearing, like its sense of smell, is very highly developed. The absence of external ears is merely another adaptation for the life which it leads.

Insatiable Appetite Owing to its high rate of metabolism, the mole needs a large amount of food to support life. Thus it spends a good deal of its time travelling the complicated system of feeding runs in search of earthworms and insects which may have fallen through into the run. Its appetite is insatiable. When confronted by food, it is roused almost to a frenzy, and it will tackle far larger animals than one would suppose.

A few years ago I kept two cream-coloured moles for some time in a soil-filled glass tank. The variety of animal food which they accepted surprised me; nothing seemed to come amiss to them! Without hesitation they tackled dead sparrows, chopped rabbit's liver, snails, slugs, and, on one occasion, a dead frog. The food was placed on the top of the tank, and, guided by their highly developed sense of smell, the moles would quickly rise to the surface and devour it with the ferocity and determination of bull terriers.

Generally speaking, however, earthworms form the larger part of the mole's diet. I had the opportunity of observing my captive moles feeding on earthworms, and it was most interesting. The worm was gripped securely by the backs of the shovel-like hands, and feeding usually began from the head end. Then, as the feast proceeded, the hands were drawn rapidly up and down to clean the soil off the worm.

Many observers have reported finding stores of earthworms in the fortress or dwelling place of the mole, the worms having been bitten about the head to prevent them moving away. I have seen this myself in many counties, usually when the dwelling places have been constructed in the middle of fields. The reason for this storage of food is probably psychological, since, although it remains active and feeds throughout the winter, the mole would quickly die if food were not immediately available. By their very nature and determination, moles cannot refuse anything, even when their appetite has been satisfied. My captive moles, even when surfeited, would still take anything offered, and this could usually be found tucked into some corner of the tank.

Moles are also very thirsty creatures, and in a colony one tunnel will invariably run to water—usually to the nearest pond or ditch. On a large aerodrome in Lincolnshire, where open water was scarce, I discovered that the moles had laid on their own private water supply by digging perpendicular shafts, at the bottom of which water was nearly always to be found.

Complex Tunnelling The depth at which a mole works is dependent on several factors. In mild weather, particularly after rain when worms are near the surface, it operates in shallow runs; but in winter, when the ground is frozen and the worms are deeper, the mole is compelled to go down for its food.

The mole has its own fortress or dwelling place, usually situated under a hedge, fence, stone wall, or anything preventing disturbance from above. This fortress will be found to be most cunningly constructed, having a number of exits admirably designed to ensure that the mole will not be at home to unwelcome visitors. From this centre is constructed a main run or highway, along which the mole can travel quickly to its place of work or feeding runs. This main run is most interesting, for, unlike the feeding runs, it is formed chiefly by compression of the soil, and there is little evidence to point to its presence. It is here that the mole-catcher sets his traps to catch the moles as they travel to and from their feeding grounds.

The mole is a fairly regular feeder, and leaves its dwelling-place every four hours or so to go in search of food, seemingly being most active at seven o'clock in the morning and at four-hourly intervals thereafter.

The breeding habits of the mole are not too well known. Breeding takes place only once a year, the gestation period lasts about four weeks, and the young are usually born in April; but they may be earlier or later depending on the season. The number of young varies between three and six; they are suckled for some three weeks.

The Mole and the Farmer How much harm does the mole do to agriculture? Since it belongs to the insect-eating mammals, what harm *can* it do? It may be argued on the one side that the mole may do a certain amount of good by feeding on insects harmful to agriculture, but, against this, it cannot be denied that the main food of the mole is the earthworm, and these are among the most useful creatures we have for the natural improvement of the soil. But mainly, unlike the rat or rabbit, which do harm by the food they eat or foul, the mole can be classed as an indirect destroyer, for it damages crops and pastures by disturbing the soil in which they grow.

In the heavier types of soil the tunnels excavated by the mole may be useful in helping to drain the land, but elsewhere tile drains are often displaced by the mole in its never-ending tunnelling.

In grassland, the soil thrown up during the winter covers a considerable area of grass which would otherwise be available to stock, and the finely turned soil provides ideal beds for windborne weed seeds. In the harvest field, hard-working reaping machines are all too frequently brought to a groaning full stop by running into mole-hills. But it is in green crops that the most obvious damage is done, for a crop of sugar beet or turnips undermined by mole runs presents a sorry sight, particularly during a dry season. Run after run is tunnelled across the field, taproots are "bulldozed" out of the way, and the soil is excavated from under the plants so that, even if they do not wilt completely and die, they never attain full and robust growth.

Few Natural Enemies Living underground, the mole does not fall victim to many predators. In fact, it does not seem palatable to many of the predatory animals and birds. Moles offered to a tame sparrowhawk were accepted only when other food was not available. On the other hand, mole remains have frequently been found in pellets cast up by tawny owls. Weasels are often caught in mole traps, but they appear to use the runs chiefly for the cover provided. There is no doubt, however, that a weasel meeting a mole would immediately kill it if more palatable food was not readily available.

Foxes sometimes hunt moles and, on occasions, carry them back to their cubs. At one time we were losing our traps every night, but they were subsequently found when a litter of fox cubs was dug out in the neighbourhood. The vixen had taken the moles complete with traps to her growing and hungry family.

Where moles are numerous, badgers develop a taste for them and become adept at catching them when the runs are near the surface. A tame badger which I had hand-reared became quite agitated when first introduced to a surface-working colony of moles, and began hunting in a most determined manner, although she had not previously had the opportunity of meeting a mole. Thereafter, my pockets were always carefully inspected when I returned home, and any moles found were eaten on the spot with obvious relish.

Trapping and Poisoning With the virtual disappearance of the old mole catcher, the farmer is becoming more and more dependent upon his own efforts to keep down the moles on his land. True, large-scale trapping of moles is an art, but any would-be trapper who takes the trouble to learn something of the habits and characteristics of this interesting little mammal should be able at least to reduce the number of moles on his farm.

Many of the old-time mole catchers devised and manufactured their own traps, and so efficient were they that many modern traps still incorporate the same principles. The traps in general use today are the " half-barrel ", " full-barrel ", " pincer ", and an all-metal patent trap which, in principle, is similar to the half-barrel but is double ended. This latter is operated by a strong spiral spring and can be set without " the touch of the master " that is needed with the barrel and half-barrel traps.

To catch moles consistently, the traps should be set in the main run, but, as I have already mentioned, this is not easily found, and keen observation is necessary before the trapper becomes familiar with the best place to set his traps. The main runs usually follow some form of top cover, and careful observation will show occasional spots where small quantities of soil have been lifted out in the course of running repairs. If the run is opened at this point it will be seen to be polished by the constant passage of the mole, and the sides of the run will show the marks of the shovel-like hands.

In these days many farmers find it easier to control moles by poisoning rather than by trapping. To prepare the bait, a good-sized worm is selected (preferably from the ground where it is intended to be used), looped over the forefinger and gripped firmly by the thumb. A nick is then made behind the head with a sharp-pointed knife and a small quantity of strychnine introduced into the cut. The prepared worm is finally placed in the run, disturbing the soil as little as possible. There is little danger of the worm escaping for, although it may move along the run, it is incapable of burrowing. An alternative method is to shake strychnine crystals over worms, which have been collected in a jar. The whole should be stirred with a twig and left for at least two hours before use.

It has been said that mole-catching is a fast-vanishing art, but it is by no means a lost one. Many experts are now employed by the Ministry of Agriculture in its County Agricultural Executive Committees to help farmers who would like to know more about mole-catching. For the farmer who finds that he has not the time himself to reduce the number of moles on his land, most County Committees also employ specially trained staff to do just this kind of work for him.

FIRE ON THE FARM

N. C. Strother Smith, M.A., A.M.I.E.E.

Director, Fire Offices' Committee, Fire Protection Association

Millions of pounds go up in smoke every year on our farms—a loss which, in many instances, could be prevented by a little forethought.

Do you recollect the situation of Talbot's barn behind the Old Manor House, near the church at Osmington? It took fire on the 28th September, when it was surrounded by fourteen large ricks at the distance of no more than twenty yards. No water—no engines—straw on every side —the barn full of wheat, and thatched cottages and corn stacks in every direction.

This description of a farm fire is taken from a letter written more than 130 years ago. Fortunately, the fire was put out with the loss of only the barn. The labourers, we are told, were encouraged in their efforts by "plenty of beer and good words", but the farmer must have been a lucky man not to have suffered serious loss. Of course, when we read an account of an old fire we invariably think: "It wouldn't be as bad as that today"; modern buildings do not burn so easily as old ones, and modern fire fighting is more efficient. But the danger of fire on farms is not diminished, and even now there are many holdings where the situation would be little better than the one described if fire did break out.

Helping the Fire Brigade The very conditions described in the letter can still be found today. Ricks, loose straw and thatched cottages are ready fuel for a fire, and if buildings and ricks are standing close together, fire can spread easily. Granted, modern fire-fighting equipment and techniques are immeasurably superior, but in rural areas the fire brigade may well have to make a long and difficult journey to reach an outlying farm. Shortage of water is frequently a problem. Water supplies which are sufficient for everyday requirements may not be adequate to deal with a large fire.

An insufficient water supply contributes more than perhaps any other single factor to fire damage on farms. The countryman's supposed habit of using ponds and streams as rubbish dumps for everything from tin cans to old bicycles may be something of a joke: but the joke may rebound on the farmer when fire breaks out. Then any natural water supplies may be invaluable so long as the fire brigade can get at them easily with their equipment. Again, it is of no avail if a pond or stream has plenty of water if there is no easy access for the pumps. For the water to be readily usable, undergrowth may have to be cut from the banks, a clinker or rubble platform laid, and weeds and rubbish may have to be cleared from the water's edge. But it is hardly to be expected that this is a job for the fire brigade! On farms remote from a fire station, some provision should be made to enable the fire to be fought by the farm workers before the fire brigade gets there. A mobile water tank that can be towed by tractor to any part of the farm is a useful piece of emergency equipment: it may even make the difference between slight and total loss.

Delays of all kinds add to fire damage. I have already mentioned the difficulty of finding water, but delay in calling the fire brigade to the scene of the fire is often as much to blame as water shortage for the losses sustained. Since the telephone is the quickest way of calling the fire brigade,

everybody working on the farm should know where the nearest one is. For freedom of manoeuvre, a fire appliance needs a good road 12 feet wide—preferably one giving direct access from the public roadway to the main farm buildings.

Modern Methods increase Fire Risk Not long after the letter from which I have quoted was written, the building of railways began and a new cause of fire was introduced. Sparks from railway engines still start many fires every year. More recently, the use of tractors and combine harvesters, grass drying or grinding machinery, and other equipment of that kind have added to the fire risk. Incubators and lamps for keeping young stock warm also figure among the dangers on the modern farm. Indeed, incubators are the principal single cause of fires in farm buildings. And as always, of course, smoking is one of the outstanding causes of many fires.

Regular maintenance is about the best safety precaution where machinery is concerned. Faulty wiring on petrol engines, exhaust sparks due to badly tuned engines, hot bearings arising from lack of lubrication, can all start a fire. In particular, when grain is being threshed and there is a good deal of dust and chaff settling on the machines, a small spark may easily reduce a threshing machine to a mass of twisted metal. Tractor exhausts commonly lead to ricks and piles of loose straw catching alight. The fitting of an exhaust tail pipe finishing vertically would prevent quite a number of these fires.

Equipment that involves a fire risk ought not to be housed in buildings used for any other purpose. Particularly is this so with drying and grinding machinery and incubators, which should be in buildings of brick, stone or other non-combustible construction, such as corrugated sheeting on steel frames. Fire-fighting equipment should be kept in all farm buildings, and extinguishers should be carried on tractors, combine harvesters and other machinery where fire is a likely risk.

Some causes of fire, of course, are outside the control of the farmer. He cannot stop a railway engine from throwing up sparks as it crosses his fields, nor prevent passers-by from throwing down lighted cigarette ends. Nor can he be sure that no children will play with matches on his land. His only defence against these dangers is to ensure, where possible, that crops and ricks are out of their reach. The risk of fire among crops growing adjacent to railway lines is lessened by a belt of green crops at least ten furrows wide next to the line.

Confining the Fire Farm buildings and ricks placed close together are a potential source of danger, since sparks can be blown easily from one to another. Ricks should be built well away from roads and public footpaths, and also spaced well apart: twenty yards is the minimum safe distance, but if this is out of the question they should at least be built across the line of the prevailing wind. Ideally, farm buildings, too, should be separated from each other, and, as an added precaution, large buildings should be subdivided, where practicable, by a brick wall reaching up to the roof.

In this short article I have been able to give only a partial picture of the danger of fire on farms. I have described the most characteristic risks and some necessary precautions, but the subject is dealt with more fully in the Fire Protection Association's booklet *Farm Fires and Their Prevention*, which is obtainable free from the Association at 15 Queen Street, London, E.C.4.

AGRICULTURAL STATISTICS ENGLAND AND WALES

June 1955, Agricultural Returns (Final)

CROPS AND GRASS

(*thousand acres*)

Description	1939	1954	1955
Wheat	1,683	2,377	1,895
Barley	910	1,874	2,108
Oats	1,358	1,469	1,489
Mixed corn, for threshing (b)	83	593	456
Rye, for threshing	(c)	41	18
Total corn	**4,034**	**6,355**	**5,965**
Beans, for stock-feeding	133	119	86
Peas, for stock-feeding	37	31	21
Potatoes, first earlies	56	120	108
Potatoes, main crop and second earlies	398	529	495
Total potatoes	**454**	**649**	**603**
Turnips and swedes for stock-feeding	396(d)	288	288
Sugar beet (for sugar)	337	423	412
Fodder beet (all types of high dry matter content)	(c)	40	24
Mangolds	210	198	176
Rape	53	144	135
Cabbage, kale, savoys and kohl rabi, for stock-feeding	94	297	314
Vetches or tares	49	24	22
Mustard, for seed, fodder or ploughing in	48	34	40
Linseed	} 4	3	2
Flax, for fibre		17	7
Hops	19	20	20
Orchards with crops, fallow, or grass below the trees	236	257	254
Orchards with small fruit below the trees	18	10	9
Small fruit, not under orchard trees	29	31	30
Vegetables for human consumption (excluding potatoes), hardy nursery stock, flowers and crops under glass	275	452	470
Fruit and vegetables, not grown primarily for sale	(c)	12	11
All other crops	48	23	38
Bare fallow	355	272	340
Total of crops and fallow (tillage)	**6,830**	**9,699**	**9,268**
Lucerne	32	111	103
Temporary grass (including clover and sainfoin):			
for mowing	1,304	2,253	2,352
for grazing	768	1,623	1,700
Total temporary grass	**2,072**	**3,875**	**4,053**
TOTAL ARABLE LAND	**8,935**	**13,685**	**13,423**
Permanent grass for mowing	4,612	2,786	2,919
Permanent grass for grazing	11,097	7,993	8,126
Total permanent grass	**15,709**	**10,779**	**11,045**
Arable and permanent grass temporarily out of use through flooding on the East Coast Jan./Feb. 1953	—	51	29
TOTAL ACREAGE OF CROPS AND GRASS (a)	**24,643**	**24,515**	**24,497**
Rough grazings:			
Sole right	4,179	3,763	3,729
Common rough grazings	1,361	1,482	1,482(e)
Total rough grazings	**5,541**	**5,245**	**5,211**

(a) Excludes rough grazings.
(b) In 1939 and 1954 included areas cut green. In 1955 these areas were included under "other crops".
(c) Not separately returned.
(d) Includes turnips and swedes for human consumption.
(e) Provisional.

SMALL FRUIT

(thousand acres)

Description	1939	1954	1955
Strawberries	18.7	17.6	17.7
Raspberries	4.1	3.5	3.2
Currants, black	10.4	11.4	10.4
Currants, red and white	2.3	1.0	0.9
Gooseberries	9.1	6.2	5.8
Loganberries and cultivated blackberries	2.5	1.2	1.1
Total	**47.2**	**40.8**	**39.2**

VEGETABLES FOR HUMAN CONSUMPTION, HARDY NURSERY STOCK, FLOWERS AND CROPS UNDER GLASS

(thousand acres)

Description	1939	1954	1955
Vegetables for human consumption (excluding potatoes) grown in the open:			
Brussels sprouts	38.0	43.8	46.8
Remaining spring cabbage (planted in previous year)		5.8	10.5
Summer cabbage		8.1	9.1
Autumn cabbage		5.0	5.1
Winter cabbage	44.1	12.6	12.4
Autumn savoys		2.9	2.9
Winter savoys		9.1	9.2
Kale and sprouting broccoli		1.9	2.0
Winter cauliflower or broccoli (heading):			
Remaining from previous year's plantings ...		2.3	3.1
Planted in the current year		9.2	8.5
Summer and autumn cauliflower:	18.9		
Early summer sown under glass and planted in the open		4.3	5.2
Late summer and autumn (open sown) ...		7.8	7.4
Carrots, earlies (grown for bunching only)	16.1	2.4	2.6
Carrots, main crop		24.0	29.4
Parsnips	(a)	3.3	3.7
Turnips and swedes	(a)	4.2	4.6
Beetroot	(a)	6.9	8.1
Onions, grown for salad	1.7	1.1	1.2
Onions, for harvesting dry		4.0	3.7
Beans, broad		4.6	7.3
Beans, runner	17.8	7.6	8.6
Beans, dwarf or french		2.0	1.8
Peas, green for market	60.6	42.7	43.4
Peas, green for canning or quick freezing		40.5	46.9
Peas, for harvesting dry:	28.0		
Marrowfats		131.9	97.3
Blues			24.5
Asparagus	2.6	1.5	1.4
Celery	6.7	4.6	4.6
Lettuce	5.9	7.1	6.7
Rhubarb	7.2	5.6	5.3
Tomatoes (growing in the open)	0.2	1.4	1.0
Other vegetables and mixed areas	(a)	14.1	14.6
Total	**247.7**	**421.9**	**438.8**
Hardy nursery stock:			
Fruit trees, fruit bushes and other fruit stock ...		4.0	3.6
Ornamental trees and shrubs	10.5	4.2	4.8
Other nursery stock (herbaceous plants, alpines, etc.)		4.0	3.9
Bulbs and flowers in the open:			
Bulbs grown for flowers:			
Daffodils (Narcissi)		2.9	3.2
Tulips		1.4	1.5
Other bulb flowers		0.7	0.7
Bulbs grown for sale as bulbs:	7.7		
Daffodils (Narcissi)		1.0	1.2
Tulips		1.0	1.2
Other bulbs		0.2	0.2

(a) Not returned.

The figures for 1954 and 1955 are based on returns which account for almost 100 per cent of the total area returned under this heading.

Description	1939	1954	1955
Other flowers, not under glass	5.8	6.6	6.5
Total	**13.5**	**13.8**	**14.5**
All crops grown under glass	**3.3**	**4.4**	**4.4**

LIVESTOCK

(thousands)

Description		1939	1954	1955
Cows and heifers in milk:				
For producing milk or calves for the dairy herd		2,255	2,170	2,064
Mainly for producing calves for beef			327	415
Cows in calf but not in milk:				
Intended for producing milk or calves for the dairy herd		392	361	351
Intended mainly for producing calves for beef			75	83
Heifers in calf (first calf)		459	660	630
Bulls being used for service		91	73	66
Bulls (inc. bull calves) being reared for service ...		43	28	25
Other cattle:				
2 years old and over	Male (Steers) ...	(a)	548	531
	Female	(a)	625	600
	Total	**944**	**1,173**	**1,131**
1 year old and under 2	Male (Steers) ...	(a)	505	559
	Female	(a)	1,017	1,044
	Total	**1,346**	**1,521**	**1,603**
Under 1 year old	Male (Steers) ...	(a)	574	608
(excluding bull calves	Female	(a)	1,105	1,064
being reared for service)	**Total**	**1,242**	**1,680**	**1,671**
TOTAL CATTLE AND CALVES		**6,770**	**8,067**	**8,039**
Sheep one year old and over:				
Ewes for breeding		7,160	5,441	5,703
Two-tooth (shearling) ewes		1,477	1,314	1,347
Rams for service		205	151	158
Other sheep one year old and over		1,021	1,374	1,082
Total one year old and over		**9,863**	**8,279**	**8,291**
Sheep under one year old:				
Ram lambs for service		156	56	66
Other sheep and lambs		7,967	6,178	6,386
Total under one year old		**8,123**	**6,234**	**6,452**
TOTAL SHEEP AND LAMBS		**17,986**	**14,513**	**14,743**
Sows in pig		(a)	333	306
Gilts in pig		(a)	137	77
Other sows for breeding		(a)	190	183
Total sows for breeding		**449**	**659**	**566**
Boars being used for service		30	38	36
All other pigs (not entered above):				
5 months old and over (including barren sows)		633	909	892
2-5 months old		1,516	2,049	1,993
Under 2 months old		888	1,223	1,192
Total all other pigs		**3,036**	**4,181**	**4,076**
TOTAL PIGS		**3,515**	**4,878**	**4,677**
Fowls 6 months old and over		23,154	27,816	27,390
Fowls under 6 months old:				
Male		(a)	(a)	4,773
Female				29,114
Sex not known				2,723
Total fowls under 6 months old(c)		**29,758**	**32,577**	**36,610**
Total fowls		**52,912**	**60,393**	**64,001**

(a) Not collected separately.
(b) Not returned.
(c) The heading for younger fowls has been divided into sexes, which may have affected comparability with previous results.

Description	1939	1954	1955
Ducks of all ages	2,237	1,278	1,003
Geese of all ages	584	564	452
Turkeys of all ages	693	1,104	1,200
TOTAL POULTRY	**56,426**(b)	**63,339**	**66,656**
Horses used for agricultural purposes or by Market Gardeners:			
Mares (including those kept for breeding) ...	347	92	82
Geldings	202	60	53
Unbroken horses of 1 year old and over:			
Light	110	(c)	(c)
Heavy		6	5
Horses under 1 year old:			
Light	15	(c)	(c)
Heavy	35	3	2
Stallions being used for service:			
Light	5(4.6)	(c)	(c)
Heavy		–(0.4)	–(0.3)
All other horses and ponies (not entered above) ...	132	93	93
TOTAL HORSES	**846**	**255**	**235**

LABOUR

(*thousands*)

Description	1939	1954(d)	1955
Regular wholetime workers:			
Male, 65 years old and over	375.3	21.9	22.3
„ 21 years old and under 65		365.6	343.6
„ 18 years old and under 21	44.7	32.6	33.2
„ under 18 years old	50.8	42.8	39.7
Total	**470.8**	**462.9**	**438.8**
Women and girls	40.3	42.5	39.8
Total male and female	**511.1**	**505.4**	**478.7**
Regular part-time workers:			
Male, 21 years old and over			43.1
„ under 21 years old			5.4
Total	(a)	(a)	**48.5**
Women and girls			30.7
Total male and female			**79.2**
Seasonal and temporary workers:			
Male, 21 years old and over			44.3
„ under 21 years old			4.5
Total	(a)	(a)	**48.8**
Women and girls			32.0
Total male and female			**80.7**
Casual workers:			
Male, 21 years old and over	57.4	87.2	
„ under 21 years old	5.9	10.1	
Total	**63.3**	**97.3**	(e)
Women and girls	32.7	55.0	
Total male and female	**96.0**	**152.3**	
Total male workers	**534.1**	**560.2**	**536.0**
Total female workers	**73.0**	**97.5**	**102.5**
TOTAL WORKERS	**607.1**	**657.7**	**638.6**

(a) Not collected separately.
(b) As a result of war-time controls many small sized holdings were recorded for the first time in 1941. It is estimated that to make the totals prior to 1941 reasonably comparable with later years some 3 or 4 million birds should be added in England and Wales.
(c) Not collected separately—included under "All other horses and ponies".
(d) Revised and more comprehensive instructions on the Labour Section of the form, introduced for the first time in September 1948, resulted in the return of additional workers. The figures for June 1954 and June 1955 are not, therefore, comparable with those for 1939.
(e) In 1939 and 1954 casual workers included seasonal part-time and temporary workers.

FARMING AFFAIRS

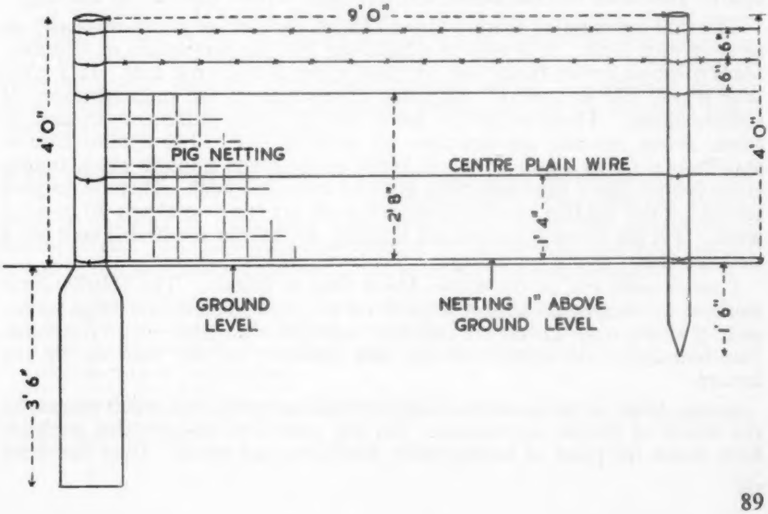
Meat and Your Market One of the outstanding problems in beef production in this country is to get supplies coming on to the market more evenly. By far the greater part comes in the second half of the year, and thus to level out supplies we need more animals to be finished for slaughter in the late winter and early summer months at about two years old. Success in the market is laid down by giving the calf a good start and seeing that it is subsequently well reared, especially in its first winter. The maximum use of home-grown feedingstuffs can secure the right kind of carcass and, what is not less important, at lower cost! Fairly young animals, not over-finished, and weighing less than 12 cwt on the hoof will give the kind of meat to meet consumer demand. Good quality, quick-fleshing cattle are essential.

Attention is focused on this important aspect of today's farming in the Ministry's exhibit at the Bath and West Show at Cardiff (May 30–June 2). Well-reared and badly-reared calves are being shown. Comparison speaks louder than words! Better permanent pasture can carry more stock to the acre and the grazing of leys can help appreciably in getting an early finish.

Besides beef, we want more mutton and lamb—especially early lamb. The story here is much the same: heavy deliveries in the autumn and winter, and only a comparative trickle in early summer. The exhibit shows what should be done in the way of right feeding and right management of the in-lamb ewe flock so as to get lambs on an early market at a carcass weight of 35-45 lb and not too fat—which is what the housewife wants. The growth-rate of lamb depends largely on the milking qualities of the ewe and the weight and vigour of the lamb at birth. Both are laid down during pregnancy.

Make a point of seeing this exhibit—Stand No. 346, Avenue F.

Farm and Forest:
14. Fencing for the Lowland Farm Except for the straining posts and netting, the materials required for a pig and stock fence on the lowland farm will be similar to those used for the hill farm fence, which I described



last month. It is recommended that the straining posts be sunk an extra 6 inches, and therefore a 7½ foot post will be required. Other dimensions can be the same. Pig netting will be required and can be obtained in rolls 32 inches wide, 12½ gauge, medium weight, at around 57*s*. 6*d*. per roll of 55 yards.

The fence shown in the diagram is quite a strong one and should withstand even the worst possible treatment. The straining posts, struts and stakes should be erected as for the hill fence, except that the straining posts will be deeper. As before, the plain wire (16 inches above ground level) can be put on first to give a line for the stakes.

With the stakes set 9 feet apart, pig netting is apt to sag unless there is a supporting centre plain wire, but this may be omitted if the distance between the stakes is reduced to 6 feet. Some slight modifications may also be necessary to meet local conditions. Thus in hunting country plain wires may be substituted for barbed wire, although the fence will not then be so effective against cattle. If there is any danger from rabbits, rabbit netting will, of course, have to be substituted for the sheep or pig netting. Such netting 42 inches wide, 1¼-inch mesh, 18 gauge is sold in 50-yard rolls. The top should be stapled to the posts 3 feet above the ground so that the bottom 6 inches can be turned outwards at right angles along the ground. This overlap should be held down by sods, placed every 2 feet or so.

The prices quoted for wire and netting in these two notes were given by a firm which regularly supplies farmers, and I believe they are fairly average. The prices of stakes and posts vary according to locality and species.

R. E. Pallett,
District Officer, Forestry Commission

At the Farmers' Club:
THE DANISH FARMER AS A COMPETITOR

There is a tendency nowadays to regard the Danish farmer as a kind of "bogy man" who works on the principle "anything you can do, we can do cheaper". But, as Mr. Ronald Ede, former British Agricultural Attaché in Copenhagen, pointed out in his talk on April 4, "there were times when, as children, we were encouraged to get rid of bogy men to help us to regain our self-confidence." In fact, no great justification exists for regarding the Danish farmer as a man apart. How then can the Danes sell their agricultural produce so cheaply?

The first outstanding feature about Danish agriculture is the emphasis on home-grown feeds. It is only in a bad year that the proportion of imported feeds to home-grown feeds rises to much more than 12 per cent. In a good year it may fall as low as 7 per cent. Then there is the preponderance of smallholdings. There are, in all, some 200,000 farms in the country and, of them, about one-half are less than 25 acres in size. The typical Danish smallholder farms about 15 acres, keeps six or seven milking cows, fattens some twenty pigs a year and has a flock of some 200 hens. There is no paid labour on the holding and the hours of work are long—perhaps 70 hours a week. Yet his is not a subsistence holding, for all the produce is sold for a cash income.

Labour costs are, on the whole, lower than in Britain. The 180,000 farm workers are employed almost entirely on the intermediate and large farms, and, of these, only 22,000 are full-time workers with their own household. The remainder are either children and relatives, or are boarded by the farmer.

Lastly, there is the question of agricultural co-operation, which permeates the whole of Danish agriculture. On the cost side, co-operative societies keep down the price of feedingstuffs, fertilizers and seeds. They can work

on what seems to us to be remarkably low margins, and the private firms have to do the same or go out of business. But it is perhaps in the field of marketing that the co-operative system makes its greatest impact. Over 90 per cent of the butter and bacon is processed in co-operative dairies and bacon factories owned and run by the farmers for themselves, with all the advantages which such control can bring.

As a country, Denmark is remarkably uniform in respect of soil, climate and altitude—a situation which has led to the evolution of an equally standardized type of farming, best described as arable dairying with pigs and poultry as ancillary enterprises. This uniformity extends also to crops and livestock. All crop varieties are tested at the Government Crop Husbandry Station, and the best are then given official approval. No Danish farmer would think of growing any variety which had not been tested and approved in this way.

This form of limitation is even more marked with livestock. Nearly all producers keep the Danish Landrace pig, which has been improved and selected through the National Progeny Testing Stations for over fifty years, and is now probably the most uniform pig in the world. Cattle are similarly specialized, having been selected on the basis of their ability to produce a high yield of butter fat (not bulk of milk), using coarse home-grown fodders as the basis of their ration.

"As I see it," went on Mr. Ede, "the main lessons to be learned from Danish agriculture may be broadly classified under two main headings—techniques and psychology. Within their uniform system of farming, they have done much by progeny tests of pigs and cattle, by milk recording and by crop trials to ensure that a high proportion of their farmers use the most efficient crops and livestock. I am sure that, in this field, we could learn a great deal.

"When it comes to what I have classified as psychology, I realize I am on dangerous ground. But I would like to stress the advantages of what I may describe as self-help among farmers. Even in the matter of progeny testing, it is the farmers and not the Government who have supported financially the scheme now in operation. Then I feel that the British farmer must develop a better sense of public relations. I have seen little or no evidence of the British farmer using advertising as a means of getting the consumer interested in what he is producing for them.

"In conclusion, I would ask British farmers to pay more attention to efficiency of production, to advertise their wares and entice the consumer every time to ask for British, provided they are satisfied that it is as good, or better, in quality than the comparable imported article. The British farmer must develop the attitude that what the Danes can do six hundred miles away, he can do better on the spot."

Toxic Chemicals and the Worker Some changes in the regulations for the protection of workers who use certain specified poisons in agriculture and horticulture came into operation on March 31 last. The new Statutory Instrument* supersedes and substantially re-enacts the previous regulations†, the principal changes being:

> Organo-mercury compounds are added to the list of substances specified in the regulations, but protective clothing (overall, hood, rubber gloves and respirator) is prescribed only when using these compounds as aerosols in a greenhouse.

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* S.I. 1956 No. 445. Obtainable from H.M. Stationery Office, or through any bookseller, price 6*d*. (7½*d*. by post).

† S.I. 1955 No. 632.

Protective clothing (overall, hood, rubber gloves and respirator) must now be worn when using " Metasystox " as an aerosol in a greenhouse. After use, rubber gloves must be washed *inside* as well as outside.

For the purpose of the regulations, soil application is no longer limited to application under gravity pressure; it now covers any method of applying specified substances to the soil in unbroken liquid form.

The driver of tractor-drawn (*not* tractor-mounted) soil application apparatus need not wear protective clothing, so long as he does not take part in the application work itself.

Hops which have been sprayed with TEPP (HETP) may now be handled without rubber gloves after twenty-four hours have elapsed since the spraying. The interval was previously four days.

Colorado Beetle in 1955 For the third year in succession no Colorado beetle breeding colony was discovered in Great Britain. Fifty-four single beetles were found during the year in England and Wales, and the following table summarizes these discoveries: records for the two previous years are included for comparison:

	1955	1954	1953
Beetles associated with or on imported produce ...	27	20	38
Beetles found on ships	17	9	12
Docksides and beaches	0	0	8
Inland on potatoes	0	0	0
Inland miscellaneous	7	2	8
Odd dead beetles	3	3	3
Aircraft	0	1	0
	54	35	69
No. of breeding colonies	0	0	0

One live beetle was found in Scotland on August 15 in a shed at Leith docks amongst potatoes imported as deck cargo on a ship from Ghent.

Thirteen of the twenty-seven beetles discovered on imported produce arrived on lettuce from Spain (5), France (4), and Italy (4); it was not possible to trace the origin of four other beetles found on lettuce. Only six beetles were found on imported potatoes—three from Belgium, two from Spain and one from Italy. The remaining four beetles were found on oranges (1), aubergines (1), and miscellaneous vegetables (2).

The warm weather during June and July caused some flights of beetles over the continental ports, and of the seventeen beetles found on shipping, ten were on ships which had called at Belgian ports.

Protective spraying was carried out in 1955 on 12,500 acres in east and north-east Kent and the north side of the Thames estuary, using DDT 25 per cent miscible liquid. This was a slightly smaller acreage than that sprayed in 1954. The weather was ideal for spraying and the campaign, which started on June 13, was completed by July 27. Potatoes in the Romney Marsh area were again sprayed by helicopter. In all, 2,321 acres were treated with DDT emulsion.

The Ministry is grateful for the support that farmers have given the Colorado beetle campaign, and hopes that they will continue to report promptly any suspected beetles they may find among their potato fields in the future.

I. R. Harrison

Appointment in Canada Mr. G. H. C. Amos has been appointed Agricultural and Food Adviser to the High Commissioner for the United Kingdom in Ottawa. He replaces Mr. G. S. Lawrie, who has had to return home on health grounds.

IN BRIEF

Twin-Lamb Disease

Pregnancy toxaemia (twin-lamb disease), which often causes heavy loss to British sheep farmers, is the subject of investigation at a number of centres, including the Nuffield Institute for Medical Research at Oxford. Recent observations from this Institute have suggested that excessive weight gains in early pregnancy might predispose ewes to pregnancy toxaemia if they are subjected to changes in nutrition or other stresses in late pregnancy. On this assumption, a system of ante-natal care has been designed as an attempt to control the occurrence of this disease.

Broadly speaking, the system has aimed at keeping down weight gains in early pregnancy by controlling food intake, either by varying the size of the fold or the amount of grazing allowed. About 6-8 weeks before lambing, depending upon the weather, the ration has been increased, either by allowing access to improved grazing or, more usually, by feeding supplements of corn, hay, etc. At the same time, provision has been made for the ewes to have plenty of exercise.

The results over the last three years with some fifty lowland flocks in England and Scotland are most encouraging. Lambing percentage has been maintained, and, in some instances, increased. At the same time, the number of cases of toxaemia was greatly reduced, and the mortality rate fell from about 15 per 1,000 to about 2 per 1,000. In the case of some commercial flocks in southern England, the drop is reported to have been even more marked.

These, of course, are only preliminary results, and the study will obviously have to be continued to take into account the well-known natural fluctuations in the occurrence of the disease from year to year.

Cocksfoot Moth Investigations

When the Cocksfoot moth really gets going, it can cause very heavy losses in seed production. In 1944, for example, the seed from a 7-acre stand of cocksfoot in Hampshire was completely lost—the total loss in the county was estimated to be between 6 and 7 tons. Since then, less damage has been seen, although the moths remain abundant on wild cocksfoot.

Only the seeds of Cocksfoot are attacked. Damage consists of the destruction of the kernel, the only external sign being a small hole in the side of the seed. These light seeds are blown away during threshing and cleaning, and often the only indication of attack is a disappointing yield of cleaned seed from a crop that promised well.

The best and easiest way to control this pest is to sow new stands away from wild and cultivated cocksfoot *and* either cut low when harvesting or burn the stubble.

Great Yorkshire Show

Further improvements to the Yorkshire Agricultural Society's permanent showground at Harrogate are planned for 1956-57 at a cost of £17,000. They will include a new main entrance, the elimination of temporary structures, some thirty additional loose boxes for horses, better roadways instead of sleepers, and the completion of drainage work.

Last year the Great Yorkshire Show had the third highest attendance

among the major agricultural shows. Profit from the event was £28,000, of which £23,000 has gone towards writing off site development costs. In the last five years, therefore, £70,000 has been written off out of a total show-ground expenditure of £278,000.

High Dam at Aswan

For thousands of years Egypt has had to raise her food from the thin green ribbon of the Nile valley. At present the country has only six million arable acres out of a total area of 247 million: yet she has 22 million people to feed, and a net population growth of 2.5 per cent a year.

The site chosen for the High Dam—so-called because it would be the world's tallest rock-fill structure—is five miles upstream from the present Aswan Dam, which, when it was opened in 1902, ranked as an engineering miracle. Through its sluices can pass the whole silt-rich Nile flood that rushes down from the hills of Ethiopia between June and October. Storage begins only in mid-November, when the water is clear; thus the reservoir is not endangered by silt. This dam represented the first large-scale effort to harness the Nile. But it can control only 60 per cent of the 66 million acre-feet of water that the river discharges each year. Through the High Dam, Egypt hopes to make use of the 40 per cent that now runs into the Mediterranean during the flood season. The great lake so made would be 5-10 miles wide, 400 miles long and would hold 110 million acre-feet of water. With such a supply, Egypt could reclaim two million acres of desert; be sure of enough water for its present farmlands even in the driest years; protect its populous downstream districts from floods; and increase its power potential by a million kilowatts.

Foreign Agriculture

Target for Pigs

Dr. G. P. Wibberley, Wye College, speaking at the N.A.A.S. Kent Conference, set the sights for profitable pig production as follows: a figure of 1.9 litters per sow per year, and 8 weaned per litter. Food consumption by the sow should fall between 25 and 30 cwt a year, and the cost of meal not more than £30 per ton. He gave the conversion rate for baconers at 3.8-4.0 and for porkers at 3.25-3.5. Eighty-five per cent should make Grade A.

Hill Farming: Extended Grants

The Government have decided to extend by seven years the period, due to end on November 6, in which schemes for the improvement of livestock rearing land may be submitted and to make available a further £5 million in grants for that purpose. It is also intended to extend for a similar period the powers of the responsible Ministers to pay subsidies on hill sheep and hill cattle.

Silo Size

A rough guide to the making of clamp or pit silos is:

2 cubic yards of settled silage weighs one ton;
1 ton of grass will make roughly ¾ ton of silage.

To obtain effective consolidation with tractors, the minimum width of clamps or pits should be 16 feet, but this figure will have to be less where only small quantities are to be ensiled, otherwise the clamp will not be long enough to get a good run over with tractors.

The Persistent Red Spider

The Fruit Tree Red Spider mite was almost unknown as a pest thirty years ago. Now it is one of the major pests of top fruits in Europe. The widespread use of non-selective pesticides and of fungicides such as lime sulphur, have apparently destroyed the mite predators and so allowed the red spider populations to build up. Damaging populations of this mite were first observed in the early 1920s, following the introduction of tar-distillate washes applied to kill the over-wintering eggs of such pests as aphids, apple sucker and various moths. Tar-distillate washes were not toxic to the winter eggs of the mite but lethal to many hibernating predatory insects, among which are found some of the chief enemies of the Fruit Tree Red Spider mite.

DDT and BHC, which were introduced into spray programmes soon after the war, were deadly to most insects, including the predators of red spider, but again had no effect on the mite. For a while it appeared that parathion might be the answer to the problem, and for a few seasons two carefully timed applications prevented the early and most important damage in commercial orchards. Nevertheless a late build-up of mites occurred, and populations at the end of the season were often much higher than those on trees receiving no acaricidal sprays.

For several years there has been an intensive search for new and efficient acaricides that are toxic to the mite in all its stages, harmless to its enemies, preferably systemic in character and safe to the user and consumer. Considerable success has been achieved, and there are now available to the grower at least three highly specific acaricides, namely, chlorbenside, chlorfensone and fensone. But the battle has not yet been won, and research continues.

Manx Wrack

The centuries-old practice of gathering " wrack " around the coast of the Isle of Man after the autumn gales is in decline. Even in recent years, 10-15 tons per acre of seaweed have been applied to the land on the island, especially for root crops, and many farmers still speak of the heavy crops which they lifted as a result. But now, only a few seaboard farmers are making use of this natural manure. Labour, time and the expense involved in its collection and transport have compelled farmers to abandon it in favour of the more convenient and certain quality of fertilizers out of the bag.

New Milk-Fruit Drink

Dutch scientists have evolved a successful method of mixing acid fruit juices with milk to make a colourful, appealing pasteurized drink that will keep for several days, or, if sterilized, for several months. The secret in preparing the milk-fruit drink is a high grade of pectin, which is mixed with the milk and sugar and allowed to stand just long enough for the pectin to throw a protective coat over the homogenized milk molecules. Acid fruit juice, such as black currant, orange or lemon, and then be added without causing coagulation. Further experimental work is being carried on at the Institute of Research on Storage and Processing of Horticultural Produce at Wageningen University. The Institute is applying for the patent on this process.

BOOK REVIEWS

Report of The Nature Conservancy for the Year Ended 30th September, 1955. H.M.S.O. 4*s.* (by post 4*s.* 3*d.*).

I hope this report will be widely read. It should do something towards dispelling the popular notion that the Conservancy is an autocratic and ruthless body, addicted to sudden swoops on tracks of delectable country, either banishing the inhabitants overnight or putting a complete stop to their outdoor activities. In fact, it is clear that the Conservancy is at some pains to co-operate with farmers, natural history societies, sporting associations, and others, in an attempt to combine preservation with the best interests of all concerned.

To the average field naturalist, the parts of the report having perhaps the greatest particular interest are those dealing with investigations into the habits and status of specific creatures. We learn with gratification, although not with surprise, that there is no evidence to justify the suggested removal of legal protection from the golden eagle. As to the buzzard; the printers seem to have introduced a little comic relief with the statement that "Contrary to expectation, the reaction of most buzzards to the *death* of rabbits has been not to lay eggs." Presumably, for "death" one should read "dearth", but even so it was surely to be expected that any winged predator might reduce or increase its egg laying according to the scarcity or the abundance of its food supply.

As to the fact of egg reduction, at least in the South-West, there is no doubt whatever. I know of one area in Devon where, in 1953, there were no fewer than 29 occupied buzzards' nests, all producing at least one young bird each. In 1955, so far as could be ascertained, no more than three young buzzards in all were reared. Those responsible for the current rather disreputable campaign against the buzzard (which, believe it or not, includes a report of a buzzard "lifting a two-year-old boy off the ground!"), would do well to realize that under present conditions the population of the unfortunate buzzard is already undergoing a substantial natural reduction. As the report goes on to say, there is no evidence that following the incidence of myxomatosis the buzzard is doing appreciably more damage to useful wild life or farm stock.

Dealing with finance, the Conservancy states that its programme for its thirty-five nature reserves is costing "the equivalent of one penny per person per year". This is surely a small price to pay for the preservation, while there is yet time, of so many "naturalist's paradises", which otherwise might eventually become irretrievably lost to the nature lover.

F.H.L.

Wool Away. Godfrey Bowen. Whitcombe and Tombs. 17*s.* 6*d.*

This book on the art and technique of shearing cannot be too highly commended; indeed, it may be said to be unique in the way it deals with every facet of this exacting process, which has to be carried out wherever sheep are kept. In his foreword the author says that there are 714 million sheep in the world, producing 3,831 million pounds of wool, and there is only one way to take the wool off their backs—by shearing. This task calls for more than physical strength and enthusiasm: it needs, as Mr. Bowen says, balance, grace, rhythm, and suppleness, with eye, brain and hand in complete co-ordination. Machines are replacing blades and shears, but the need for manual dexterity in machine shearing is even greater than it is with blade shearing.

The scope of *Wool Away* is comprehensive. In addition to explaining shearing technique very fully, the author deals with the diet and clothes of shearers, the handling of difficult sheep, crutching, the construction and maintenance of shearing equipment, the design and planning of wool sheds, and the design of sheep-yards. The final chapter, which describes the types of sheep kept in New Zealand, with particular reference to their shearing qualities, is particularly interesting.

The book is copiously illustrated with photographs showing all stages in the shearing procedure, and there are some excellent line drawings of shearing equipment and shed layout.

Mr. Bowen has written his book solely on the basis of New Zealand experience, with its essential set-up of equipment and yards for handling very large flocks, but, for all that, much of the book can be studied with profit by everyone in this country who owns sheep or who is called upon to shear them.

J.F.H.T.

BOOK REVIEWS

History of the Second World War: Agriculture. KEITH A. H. MURRAY. H.M. Stationery Office. 30*s.* (31*s.* 5*d.* by post).

Of all industries, agriculture seems least suited to large-scale organization. Its products range from vegetables grown in a few weeks to milk and beef, the fruits of years of work, and each has its own soil and climate requirements; on every farm enterprises interlock. And every farm is a private business with its own finance, its own human problems. Hitherto national organization has been attempted only in slave-states, under repressive police régimes. Sir Keith Murray's history records what a democracy which accepts some suspension of civil rights can achieve in war-time.

The tale begins naturally enough with the work of the Food Production Department of the Ministry of Agriculture in the 1914-18 war. But before planning began for the greater war which was to follow, much had happened in the body politic of England; an altogether new conception of the functions of government had grown up. When the Second World War came, a shrewdly conceived plan for food production existed at least in outline and some steps had been taken to set the machine in motion. The period of the "phony war" gave the organization a chance to settle down, and for some of the controversial issues between Government departments to be ironed out.

The history traces year by year the changes in food requirements as the fortunes of war fluctuated, the measures taken to meet the growing demands, and the extent to which objectives were attained. The broad results are already well known. We became a country of alternate husbandry, increased our production of corn and potatoes; meat production fell, largely owing to reduced importation of feedingstuffs; milk, after an initial fall, regained its pre-war level.

No one criterion serves as a satisfactory measure of this revolution. The steady decrease in the area of permanent grassland, the maintenance of cattle numbers, with the fall and recovery of milk output and the sacrifice of pigs and sheep, the total human food produced, whether measured in calories or proteins, the net production when allowance is made for imports of goods and services, the output per man, the shipping space saved, and, finally, the effects of war-time methods on land fertility, all have to be reviewed to get a fair picture of the changes involved.

The author is critical of the methods used in fixing prices during the early years when the "annual review" was being evolved; like many others, he seems to feel that State monies were not very equitably allocated between different types of farming, and that arable products were more favourably treated than animal products. He judges also that earlier steps might have been taken to set in motion the measures which ultimately brought about a recovery in milk output. Of national finance and social questions arising out of the powers vested in the Minister and his agents, little is said; these problems belong to the post-war years. But on the whole his verdict on agriculture's war effort is entirely favourable.

Though Sir Keith writes with the dispassionate objectivity of an economist, he does not seek to hide his admiration for "the efforts and ingenuity exercised on hundreds of thousands of farms all over the country", by which the revolution was accomplished. And he pays generous tribute to the manner of its organization and the work of the County Committees, on whom the success of the Government's policy rested. "No other industry," he says, "was entrusted with such a measure of self-control as was agriculture—and the trust was not misplaced."

W.B.M.

Chick Management from the Day-old Stage (6th Edition). I. W. RHYS. Poultry World. 1*s.* 6*d.*

This is a very useful booklet for those contemplating taking up poultry farming. Mr. Rhys has a wide knowledge of the subject of chick rearing and has recently been appointed Director of one of the Poultry Progeny Testing Stations set up in connection with the Ministry's Poultry Stock Improvement Plan.

Notes on rearing under broody hens or in artificial equipment are followed by an excellent chapter on the care and management of appliances, which will repay careful study and the practice of its precepts. In the chapter on "Feeding" some notes on the use of home-mixed rations would perhaps have a wider application if grassmeal of good quality was referred to in addition to, or in place of, lucerne meal: the latter is not always easy to get.

The production is clear and easy to read and the illustrations are well chosen to bring out specific points of management. But the publishers would add to the value of the booklet by giving the date of revision and publication on the occasion of each reissue.

W.M.A.

BOOK REVIEWS

Lucerne Investigations, 1944-1953. (The Grassland Research Institute Memoir No. 1). 10s.

In view of the increasing interest being taken nowadays in lucerne growing, this memoir, which consists of a number of contributions by the staff of the Grassland Research Institute, Hurley, together with a paper by L. A. Willey and A. Zaleski of the National Institute of Agricultural Botany, Cambridge, is both opportune and valuable.

The first paper, by J. O. Green, summarizes the practical considerations which affect lucerne growing in Britain, and the means whereby effective utilization of such a plant can be accomplished. This is followed by an all-too-brief description of the work of the N.I.A.B. on lucerne strains and their yield and quality in relation to one another. In my opinion, the possibilities of lucerne seed production in this country could, with advantage, have been explained at greater length: the text reference to the data shown in Figs. 3 and 4 of this article also needs correction.

The emphasis in the third paper is again on strains, and, in particular, their reaction to differential cutting dates and rest periods during the season. Here the presentation of the data is rather confusing and at times difficult to follow without continual reference back. The next four papers report on experiments on the effect of cutting and grazing treatments both during and out of the growing season. The effect of autumn and winter grazing of lucerne and lucerne-grass stands is discussed, showing the accumulative effect from year to year of differential treatment upon the yield and quality of the produce. This section needs careful reading but much useful information can be gleaned by a close study of the results presented.

The last contribution summarizes the results of a number of experiments conducted from 1945 to 1952 by the Grassland Research Institute at Stratford-on-Avon. These relate mainly to the value of certain companion grasses upon the yield and quality of lucerne stands. The effectiveness of winter grazing in checking grass growth, the fact that frequent summer grazing diminishes dry matter yield and that the higher seeding rates of the grasses should be avoided, is stressed. Meadow fescue proved to be the most suitable companion grass which, at the same time, was capable of preventing weed competition. Reference is also made to the value of alternate lucerne-grass drills to avoid competition between the two plants.

Copies of the publication are obtainable from The Grassland Research Institute, Hurley, near Maidenhead, Berks.

G.P.H.

Cattle Fertility and Sterility. S. A. Asdell. J. and A. Churchill, London. 42s.

This book is an expansion of lectures given at the Royal Veterinary College. After chapters on the anatomy, histology and development of the genital organs in the bull and cow, details of the reproductive cycle and its control are considered. Heat, ovulation and the timing of service are discussed and some most useful information is given about the detection of heat, its length and the intervals between heats. A chapter on the properties of semen includes information about its storage and use in artificial insemination.

Changes in the relative growth of the uterus and its contents are described in the chapter on pregnancy, which also deals with the duration of pregnancy in different breeds, the occurrence of twins, pregnancy tests and egg transfer. A short chapter is devoted to the difficult problem of hormone levels. Among the non-pathological factors affecting infertility, the effects of nutrition (including mineral and vitamin deficiencies) and the role of inheritance are dealt with.

A chapter on disease includes reference to Brucellosis, Vibrio, Trichomoniasis and other agents. Here the approach is that of the husbandman in the prevention of the disease, rather than a detailed account of treatment. The last chapter on functional sterility and embryonic mortality deals with nymphomania, persistent corpora lutea, freemartins and climatic effects. The important subject of early embryonic death and the part it plays in lowering the conception rate is also discussed.

The book is well illustrated, the figures being drawn very largely from research work done at Cornell University. A number of references to recent literature are given, and altogether it is a most useful and up-to-date book not only for livestock and veterinary students, but for anyone interested in the problems of animal reproduction.

J.H.

Diseases of Poultry (4th Edition). ERNEST GRAY. Crosby Lockwood. 14*s.*

Popular books on disease can usually be expected to find a ready market among owners of livestock. This book, first published in 1940, is now appearing in its fourth edition, so the author can claim with some justification that his presentation of the subject has met with public approval. It is disappointing, therefore, to find so much out-of-date information in this latest edition. The poultry-farmer will learn little from it about the advances made in recent years in the treatment of such diseases as blackhead, coccidiosis, worms, pullorum disease, fowl typhoid and salmonella infections; yet this information has been readily accessible in scientific papers for at least a year or, in some instances, for much longer.

There is always a danger that the layman will regard the health of his stock as being dependent entirely on whether or not they contract specific diseases. Mr. Gray rightly stresses the supreme importance of management and nutrition as predisposing causes of ill-health. For a proper understanding of the close relationship between disease and management, some knowledge of anatomy and physiology is also valuable, and this the author has gone to great lengths to provide. There are, however, a number of minor inaccuracies in the book and some statements which, although ostensibly factual, are, in reality, expressions of the author's own rather unorthodox views on certain subjects. Furthermore, it is, in my opinion, quite inadmissible to use a publication of this type to advocate specific treatments, the efficacy of which has never been confirmed by other authorities. Such a procedure may well lead to disappointment and disillusionment for the unfortunate owners of diseased flocks.

In spite of the apparent favour which previous editions of this book have found in some quarters, this new edition cannot be recommended as a reliable guide to the diseases of poultry.

J.D.B.

Bacteria in Relation to the Milk Supply (4th Edition). C. H. CHALMERS. Arnold. 21*s.*

The fourth edition of this well-known, and deservedly popular, text-book will be welcomed by all who are in any way interested in dairy technology. It is six years since the last edition was published, and in the interim important advances have been made in the bacteriology of milk. Such changes have necessitated the revision of a good deal of the book. Within a comparatively small space, Mr. Chalmers has dealt with his subject admirably, and the book will continue to be the guide for the commercial dairy bacteriologist which its author claimed it to be when it was first published. At the same time, the new edition will be of value to dairying advisers and to workers in related fields such as the public health and laboratory services.

The book deals in detail with the sampling of milk—a subject of considerable importance and calling for great care, especially where official statutory tests have to be made. The various bacteriological tests to which milk may be subjected are adequately covered, and the techniques are clearly described. By its nature, milk is particularly liable to become tainted, and abnormal conditions in milk are frequently met. The author deals fully with these important aspects of his subject, which are frequently of bacterial origin.

Perhaps one of the most important chapters in the book is that dealing with the isolation of organisms from milk and their identification. Of necessity, the portion of the book dealing with the application of bacteriology to practical field conditions is treated less fully than the purely bacteriological side of the subject. The chapter on the pasteurization and sterilization of milk, however, is particularly well done and the illustrations, although few, are excellent. This reduction in the number of illustrations is, unfortunately, the first tangible sign of the rising cost of book production.

The subject of detergents and chemical sterilizing agents is referred to, and English readers will be interested to note that in Scotland the use of hypochlorite solutions for the cleansing of dairy utensils is still not permitted. The position in England and Wales could with advantage have been stated rather more forcefully, since the use (or, in too many cases, the misuse!) of hypochlorite solutions is the rule. This subject is of great interest at the present time, as a result of the publication of recent work carried out at the National Institute for Research in Dairying on the use of *immersion cleaning* of equipment.

This is a well-balanced book, and can be strongly recommended.

S.S.

Build Your Own Farm Buildings. FRANK HENDERSON. Dairy Farmer Books. 21*s.*

Most of the farm buildings in Britain today were designed many years ago to suit circumstances in which cheap labour was plentiful and mechanization almost unheard of. Such buildings are having either to be adapted to serve modern needs or else replaced. The building work which this entails can be done by a contractor, by a contractor assisted by the farmer, or by the farmer on his own; and there is a growing tendency among farmers to undertake more and more of their own building work, particularly if they are owner-occupiers.

There has therefore been a need for something farmers could read to assist them in tackling building problems, and, in consequence, this book is sure to be widely read. Extending to over 200 pages, with nearly as many line drawings and photographs, it is the most comprehensive work on the subject of farm buildings that has appeared for several years. It has the added advantage of being clearly written.

The title of the book is a little misleading, because the subject-matter is of interest to a wider field than farmers alone: it provides valuable information for architects, land agents, builders, students, and all concerned with the provision of fixed equipment for farms. There is, incidentally, a section on roads, fences and cattle grids.

N.K.G.

Controls and Subsidies on Agricultural Products and Requisites: I. Wool, 1939-54; II. Barley, Oats and Rye, 1939-54. H. FRANKEL, Agricultural Economics Research Institute. 2*s.*

This is the sixth, and the last in the 1954 programme, of a series of supplements published by the Agricultural Economics Research Institute, Oxford, dealing with the control of prices and distribution of home-produced and imported agricultural products and requisites, and with the subsidies associated with this control from 1939 to 1953-54. Between them, the six publications deal with the marketing of pigs, bacon, eggs, meat and livestock, the hill sheep and hill cattle subsidies, wheat, flour, bread, sugar and sugar beet, potatoes, wool, barley, oats and rye.

As with the earlier supplements, the present booklet condenses a great deal of information into a compact and very coherent history of the commodities dealt with. In Part I there are separate sections covering wool prices and subsidies under (U.K.) Government marketing; the British Wool Marketing Scheme; prices and subsidies under the British Wool Marketing Board; and the marketing operations of the U.K.-Dominion Wool Disposals Ltd.—the organization established after the war to dispose of the large stocks of Australian, South African and New Zealand wool then in the hands of the U.K. Government. Part II is concerned with the marketing and prices of coarse grains under Government control; with the range of subsidies and the Ministry of Food losses; and with coarse grain marketing and prices after decontrol.

Both sections are well documented and supported by a wide range of statistics.

M.M.

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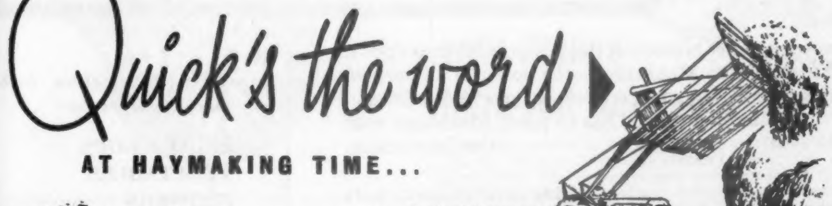

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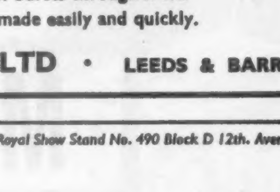

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